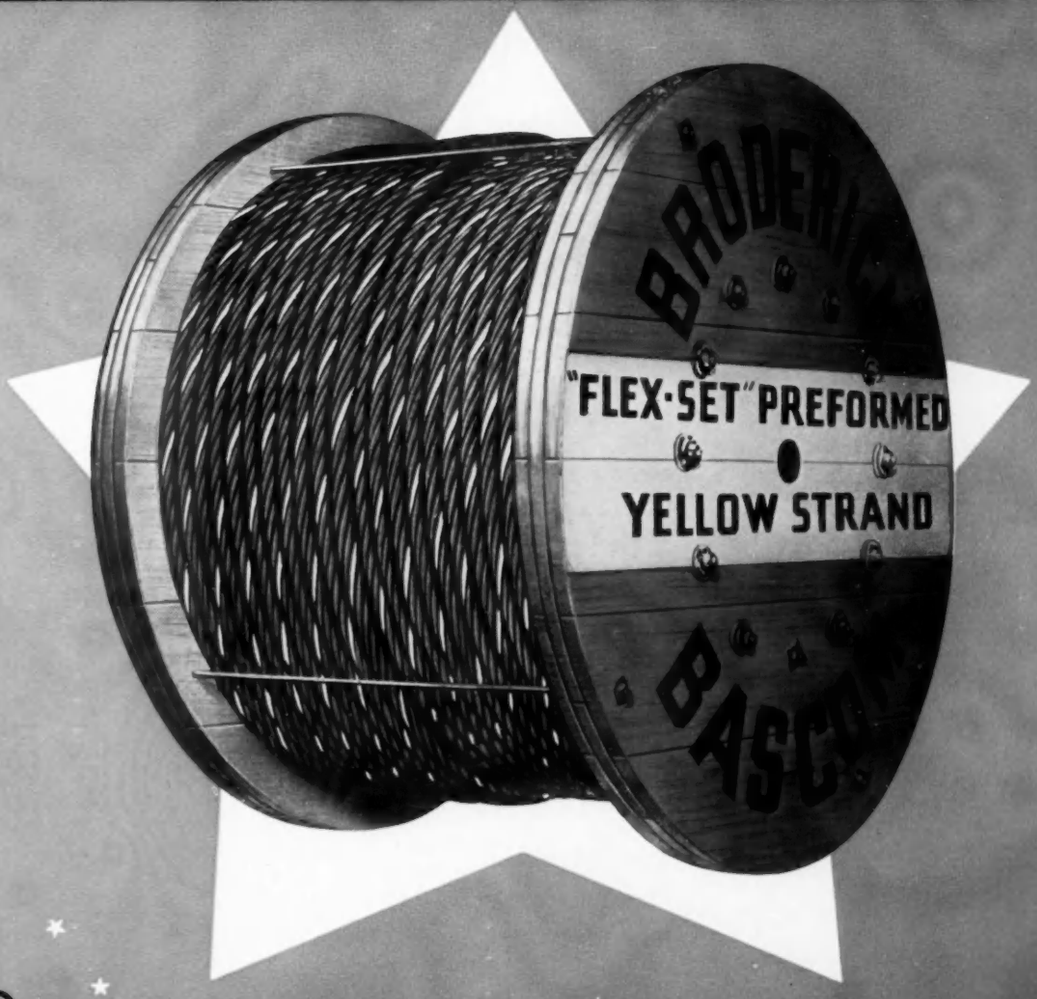
The OIL WEEKLY



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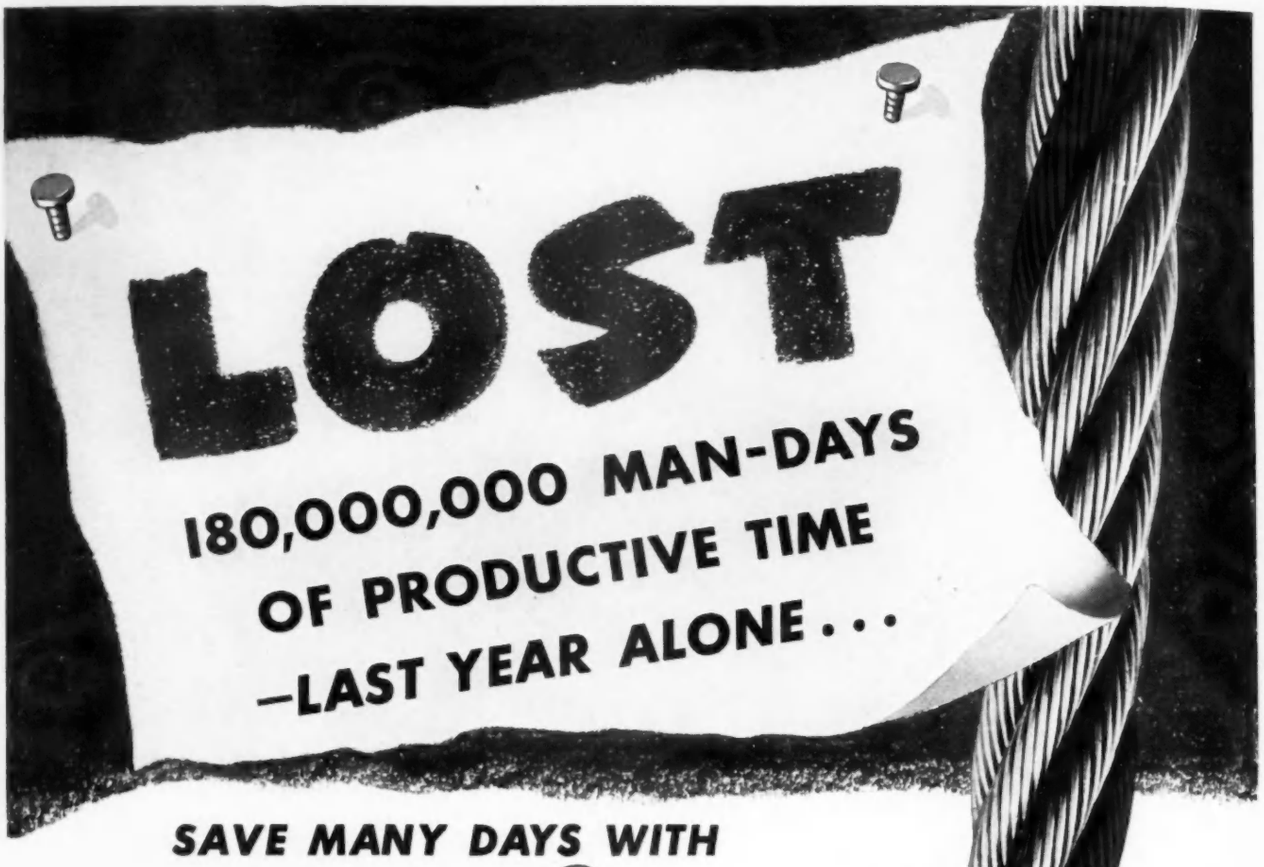

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LOOKING AHEAD
. . . with the Editor

NEED for increased oil exploration, the best means of improving discovery rates, and the proper place of the trained prospector during the war will be critically examined from every angle this week during the joint conventions of the American Association of Petroleum Geologists, the Society of Exploration Geophysicists, and the Society of Economic Paleontologists and Mineralogists.

The theme of oil-prospect trends and wartime needs will dominate the programs. Because this subject is the No. 1 interest of the industry at present, the addresses and studies delivered at the convention will receive much attention. THE OIL WEEKLY of April 12 will report the meeting to the industry at large.

The Oil Man's Calendar

APR. 7	Society of Exploration Geophysicists, Texas Hotel, Fort Worth, Texas.
7- 9	American Association of Petroleum Geologists, Texas Hotel, Fort Worth, Texas.
8- 9	American Petroleum Institute, Division of Production, Eastern District, Wm. Penn Hotel, Pittsburgh.
29-30	American Petroleum Institute, Division of Production, Southwestern District, Rice Hotel, Houston.
MAY 5- 6	Petroleum Electrical Association, Houston.
6- 8	American Institute of Mining and Metallurgical Engineers, Petroleum Division, Baker Hotel, Dallas, Texas.
20-21	A.P.I. Mid-Continent Section, Production Division, Tulsa.

THE OIL WEEKLY

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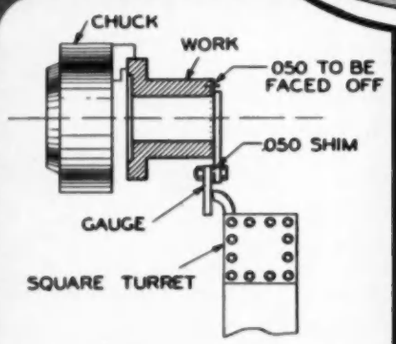
Ideas for VICTORY

. . . from the Production Lines behind the Firing Lines

Mr. Schoen receives his Warner & Swasey Victory Pin and the congratulations of the joint Management-Labor Committee which steers the Packard Motor Car Company's WORK TO WIN War Production Drive.

A Citation for Men in War Industry



GEAR BLANK—
Finish after Carburize

- A gauge is made by clamping two pieces of cold-rolled steel together with a shim between them, *same thickness as amount of metal to be removed.*

The gauge is placed against face of work. The cutting tool is then brought against the gauge blade and the carriage locked in this position.

THIS JOB SETTER WORKED OUT A TIME-SAVING WAY TO MACHINE A SHOULDER FROM A FINISHED FACE

CHARLES F. SCHOEN, a job setter in the Packard Aircraft Engine Division, which produces Rolls-Royce engines, is one of several score of turret lathe operators now wearing an Ideas for Victory Pin. These Victory Pins are given to resourceful operators who have developed practical ideas for increasing production.

Mr. Schoen's idea is explained in the accompanying sketch. To machine .050" off a finished and carburized face when length of piece may vary from job to job, Mr. Schoen made up a gauge that provides a quick way of positioning a cross-slide tool without necessity of measuring each cut.

Many of the ideas sent in to Warner & Swasey are published in Blue Chips, a shop bulletin sent free to the homes of over 38,000 turret lathe operators. Make sure your turret lathe operators are on our list to receive it—it may bring them helpful ideas and inspiration that will be reflected in increased production in your plant. Write Warner & Swasey, Cleveland, Ohio.

WARNER & SWASEY FOR VICTORY

YOU CAN TURN IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

The Changing Panorama

Lack of Manpower May Cripple Oil

MANPOWER will be one of the most serious problems confronting the oil industry before the end of the year, especially if married men are drafted in numbers now indicated. Men continue to be drafted into military services from essential jobs within the industry, despite rulings that oil is vital and its men should be deferred.

The industry is expected to produce the largest quantity in its history. It is expected to refine and transport the largest volume on record. It must make aviation gasoline, tuolene, synthetic rubber, and other special products in ever-growing quantities. Huge quantities of oil must be discovered to assure an adequate supply. Wildcatting must be increased to the highest record in history, 4500 wildcats during 1943 is the goal. This is 50 percent more than in any other year. This means that prospecting crews must be the largest in history, although at a peak last year. These men are one of the groups military services seek most diligently of all. There are many instances where the drilling of important wells are being delayed because of inability to obtain crews.

If the draft upon the industry's manpower by both military and other industries is not checked, oil very likely will be crippled to the point that it cannot realize the goals expected of it. Then it may become necessary to release men from the Army and force those employed in other industries to return to the industry, as the British did with its coal miners and as the United States now plans to do with its experienced farm hands.

Not only this nation, but the whole Allied group, is dependent upon the United States oil industry achieving the responsibilities thrust upon it by a mechanized global war.

Performance Should Decide Rubber Fate

A GROWING number of government officials, including some in the Rubber Director's office itself, seem to be entertaining the belief that postwar United States will have no place for the synthetic rubber industry now being built at great expense and with direly needed critical war materials.

Mainspring of the group apparently is Vice President Henry A. Wallace, who early this year said the synthetic rubber industry should be abandoned after the war in order not to starve the natural-rubber-producing areas of the world. Later Wallace is credited with stating he did not believe the synthetic product should be supported by a duty on imported natural rubber. Others see the fate of the synthetic industry as being doomed by inability to compete with natural-rubber prices. Many appear to be placing their faith in Brazilian hevea rubber, guayule and what is claimed to be an even better shrub native to Haiti, where an organization has been organized to exploit it. These rubbers, together with such rubber as may be available after the war from the Pacific areas, they believe, will be available at prices with which the synthetic will not be able to compete. Another argument for killing synthetic rubber before it is started is that none of the types now to be produced are equal to natural rubber.

Rubber is the most critical of all shortages in this nation. It has done more to delay the war effort and disrupt civilian economy than any other scarce commodity. Yet this group would trim the synthetic rubber program to bare foreseen military requirements, and therefore gamble the fate of war production and civilian economy. If and when there is another Pacific war, the United States again might be faced with a similar crisis unless its synthetic industry is permitted a fair chance to see what it can do.

The fate of the synthetic industry should be decided by its actual performance during the next year or two, when it will be produced in large quantities. As yet, it has not had an opportunity to take advantage of mass production to bring costs down. It may surprise many. Likewise, further research may result in a rubber superior to the natural product. Great strides have been made already, and it is the newest big-size industry in existence.

Fortunately, there are just as many men in Washington who believe that synthetic rubber will open up entirely new fields where it will be used in lieu of natural, just as rayon took the place of cotton, nylon of silk, and plastics of metal in many uses.

And as regards "starving" the little brown men who get out the natural rubber, it should be remembered that they were the source of much wealth to the British and the Dutch long before they knew anything about rubber trees.

Alcohol-Gasoline to Revive After War

DEMANDS for the compulsory blending of alcohol with gasoline which died down in Congress when we entered the war are expected to be revived with increased force after the end of the conflict.

This possibility is seen in the disclosure that the War Production Board and Defense Plants Corporation are engaged in preliminary negotiations with the Consumers Cooperative Association of North Kansas City, for construction of a 10,000,000-gallon grain alcohol plant near Keokuk, Iowa.

The plant construction would cost $1,400,000 to be furnished by DPC. It would be operated by the Farm Products Cooperative Association, a subsidiary of Consumers Cooperative.

Plans call for immediate use of the alcohol in military products, but contemplate continuance of operations after the war, with the product to be used for motor fuel, smokeless powder for farm purposes and anti-freeze compounds.

Mixing of Coal and Fuel Oil Suggested

MIXTURE of 3,000,000 tons of coal with residual fuel oil, in the ratio of one-third coal and two-thirds oil, would save 15,000,000 barrels of oil a year in war industries of the East, it is estimated by the Bureau of Mines.

A bureau report made public by Representative Hartley of New Jersey, chairman of a committee which held hearings on the subject, placed the cost of the 25 plants needed for preparation of the fuel at $3,125,000 and estimated the cost of manufacture, excluding the cost of the product but including operating cost and complete amortization of plant investment in one year, at 19 cents per barrel.

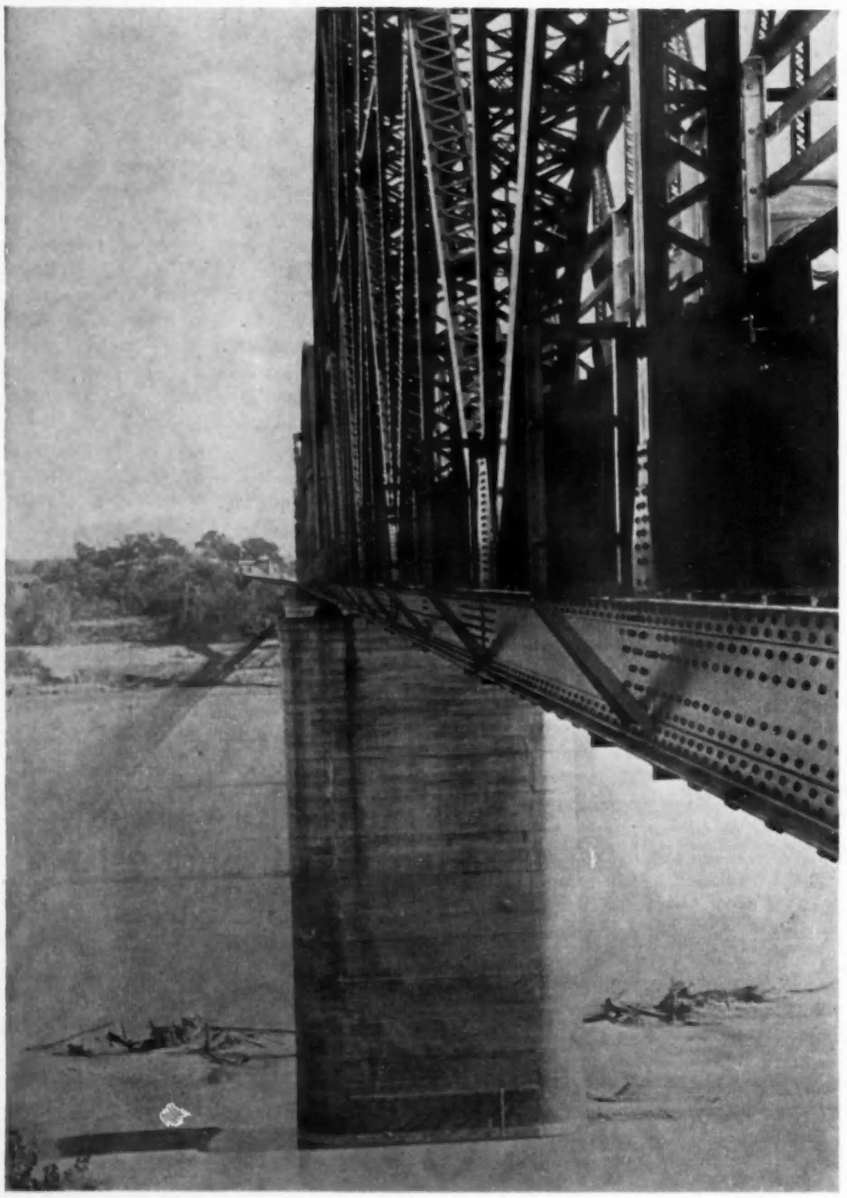
A mixture of 40 percent coal and 60 percent oil would save even more than the 15,000,000 barrels of oil on which bureau

computations were made, it was pointed out.

While the bureau saw colloidal fuel as a means of saving oil in the Eastern shortage area, it also saw in it an answer to the danger of death to men on torpedoed vessels from burning oil on the surface of the water.

"Vessels on the high seas operating on colloidal fuel, attacked by submarines, will be robbed of much of the danger to human life because the release of the fuel to the ocean waters will result in the fuel sinking and thus preventing the surface fires that have caused the high injury and death risks to crew members who have had to jump into the water to avoid sinking with the boat," the bureau explained.

"While this effort is directly inspired by the present war emergency," it added, "the introduction of colloidal fuel is not to be considered in any way as merely an emergency remedy. Its introduction will prove itself a completely justified conservation effort. This will be a positive contribution to the conservation of the country's known oil deposits, and at the same time will provide an outlet for the coal reserves, which are estimated generally to be ample."



—Photograph courtesy United Gas Log

Welded to existing truss members without hampering traffic or altering structural characteristics of the bridge, these roller-equipped brackets will eventually carry two 14-inch gas lines. Such carrying of lines on the outside of bridge trusses, when the pipe line is planned to cross a stream near such a structure, eliminates the costly—and vulnerable—river crossing with its weakness under ice, flood and stream bed shifting. If additional Mississippi River floods cause trouble, perhaps such a provision for the big-inch, splitting it into as many as four 14-inch lines for the actual bridge span, could be used to prevent delays and eliminate losses such as the one which set back initial opening of the first leg of the line by several weeks.

States Must Encourage Secondary Recovery

THE Oklahoma House last week killed the Batson Bill (HB1332), which would have promoted secondary recovery in depleted areas by providing means for cooperative unitized programs where the majority of operators desired.

Despite criticism, much of which was ill-founded, the bill was drafted carefully. Engineers, production men, field men, lawyers, and big and little operators had conferred at length in many sessions to make the proposal as fair and applicable as possible. The measure was looked upon by these men as a model for similar enactments in other states.

One argument against the measure was that it would bring federal control of secondary oil production. Actually the reverse was more to be anticipated, for if states continue to be dilatory in providing some vehicle for secondary-recovery programs there is likelihood that some such action will take place in Washington. Under provisions of the measure, the Oklahoma Corporation Commission would have been the governmental authority.

With a reduction of reserves and a parallel decrease in new discoveries, the industry must turn more and more to the recovery of that oil left in reservoirs after normal producing methods are through. Secondary recovery as a result will become of increasing importance. In Oklahoma, where reserves as of January 1 were 975,000,000 barrels, it is estimated an additional 450,000,000 barrels might be produced by secondary-recovery methods. Even now, from secondary operations come one barrel of every six produced. Yet the state legislators would not pass a measure that would encourage adoption of secondary recovery, which might have retarded the state's declining production.

With this means of producing oil to become more important, every oil state must sooner or later formulate some means of advancing this type of development. The first step is to encourage the pooling of interests into a cooperative program, for neither gas repressuring or water flooding can be instituted on a broad scale in areas where ownership remains divergent and scattered.

Current rate of finding oil so low, productive capacity will be inadequate by end of year to meet growing consumption. Situation calls for increased exploratory funds, use of all prospecting means and more cooperative effort.

Problem Of Exploration During the War

By E. DeGOLYER
Assistant Deputy Petroleum Administrator

IT IS a well-known fact that the ability of the United States to produce war materials will be one of the principal determinants in winning the war. The ability to produce finished products for war will be greatly dependent upon the availability of raw materials. Crude petroleum ranks among the most important of those materials. Yet the nation's oil productive capacity is already being severely strained to meet the war petroleum requirements.

Demand for crude oil produced in the United States was roughly 1 billion 400 million barrels in 1942. This was a decrease of only 1 percent from the preceding year despite the restrictions placed on nonessential consumption. The presence of many variables precludes an accurate forecast of the overall petroleum requirements for the duration. The more conservative estimates range from 1 billion 500 million to 1 billion 600 million barrels annually for the next 2 or 3 years. It is logical to expect that as the tempo of war increases and the theaters of war spread, the essential war requirements for petroleum will increase accordingly.

The nation was fortunate in entering this war with a substantial backlog of reserves of some 20 billion barrels. Unfortunately, it is now facing the prospects of greater demands at a time when the rate of discovering new reserves is disturbingly low. This is a matter of deep concern, not because of the effect on our reserve position, but because of the stern need to maintain a productive capacity adequate to supply all war and essential civilian requirements.

The question may be raised as to why this should be a matter of concern when the nation still has a productive capacity of three to four hundred thousand barrels daily that can find no outlet. Part of the answer is that this excess capacity is largely in the Permian Basin of West Texas-New Mexico, in the Gulf Coast of Texas, and in Southwest Texas where it is not presently accessible because of limited transportation facilities or because of the fact that the oil is not of a type particularly suitable for the manufacture of war products in existing plants. Even though these transportation difficulties are solved, as they must be, the productive capacities of other areas will continue to decline unless substantial new reserves are discovered. Furthermore, we have not yet had to meet our full war demand.

The reserves in new fields discovered annually since 1938 have been substantially less than the yearly production from the nation's oil fields. In the 4 years ending December 31, 1938, the total reserves in new fields discovered averaged 1 billion 960 million barrels annually, while production was at the average rate of 1 billion 150 million barrels annually. For the subsequent four-year period, new reserves discovered averaged 640 million barrels annually and crude-oil production was at the average annual rate of 1 billion 380 million barrels. Although the estimates of reserves discovered during recent years may be materially increased by further development, it is highly improbable that the discovery rate for the past 4 years will closely approach the production rate.

The unsatisfactory results obtained from exploration are not the result of any slackening of the exploratory effort. Since 1939 slightly more than 3000 wildcats have been drilled each year; a number greater than that during any earlier year for which records are available. In excess of 300 geophysical and core-drill crews were employed throughout 1942 and are presently employed, a performance that exceeds by 12 percent similar prospecting activity for any prior year. An examination of these indices leads to the conclusion that intelligently directed exploratory effort is at an all-time high. The results obtained from such efforts are diminishing, however, and are presently inadequate.

Nor are the disappointing results of exploration accounted for by a reduction in the total number of new fields discovered. During the four-year period, 1935-1938 inclusive, an average of 130 new oil fields were found annually. In the four-year period, 1939-142 inclusive, new field discoveries averaged nearly 215 annually. The answer appears to lie in the rate at which large fields are discovered.

The most recent estimates of the average new oil discovered per field are 15.6 million barrels for the 1935-1938 period and 3.2 million barrels for the 1939-1942 period. The average size of new fields discovered in 1942 is now estimated to be 1.2 million barrels. Further development of these fields will undoubtedly increase this estimate but not to a size comparable with the fields discovered prior to 1939. For the past 8 years the number of new oil fields discovered annually has increased almost

year by year. During the same time, because of the rapidly decreasing size of new fields being found, the total new reserves uncovered have constantly diminished.

The geophysical and core-drilling activity of today reveal the prospects on which the wildcats of tomorrow will be drilled. While these prospects are not yet susceptible of quantitative analysis, I am advised by many operators that their first-rate prospects now compare with the second- and third-rate prospects of the middle thirties. Thus the outlook for discovery in the immediate future is not encouraging.

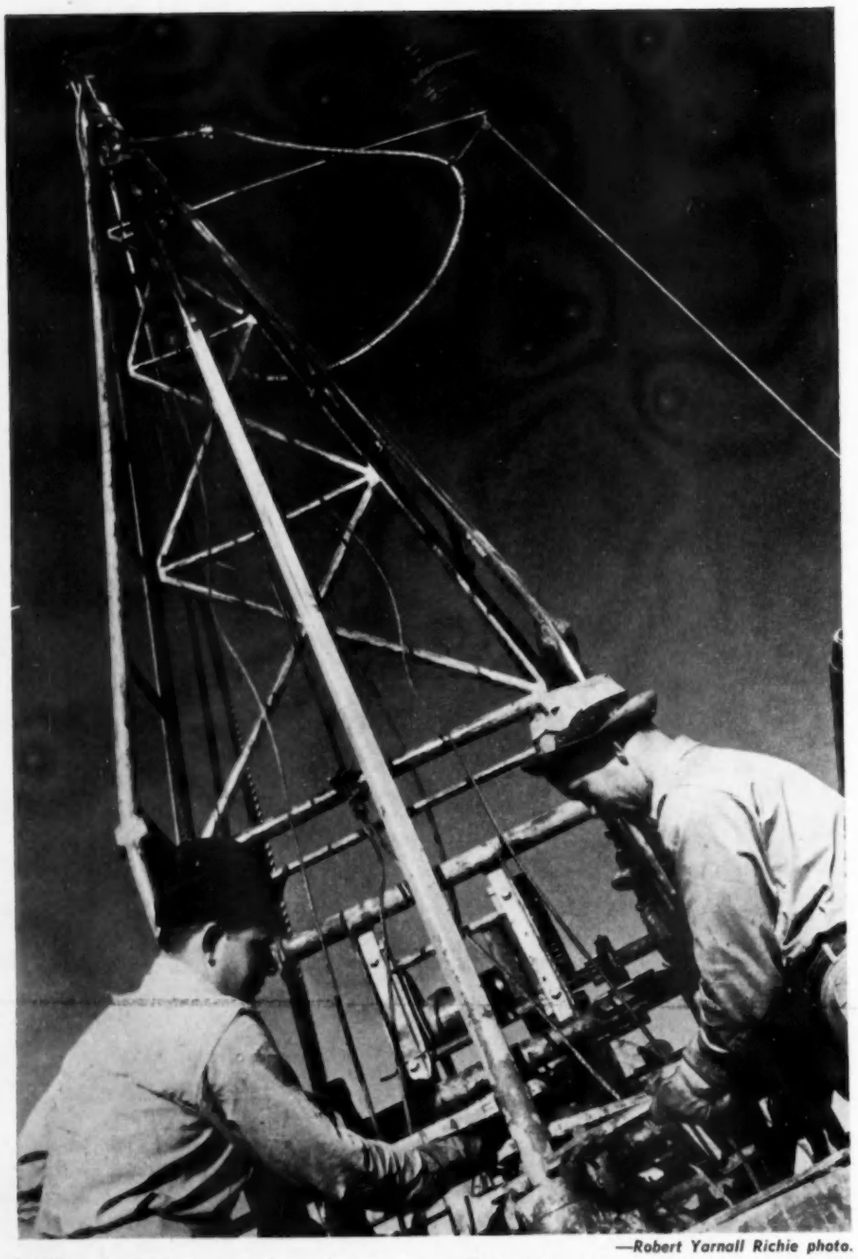
The history of oil prospecting indicates that it has been guided by a series of more or less separate techniques and methods. The early day prospector was principally guided by the surface occurrence of oil and gas seeps or asphalt deposits. Next the prospector turned to the testing of anticlines and domes found first by the surface geologist and later by the sub-surface geologist.

In 1924, a new finding technique was introduced—geophysics. First, the refraction seismograph was used and evidence of its worth is seen in the upsurge of new findings in the latter part of the 1920's. As the areas susceptible to this type of examination were fully explored and tested this method was generally discarded. Shortly thereafter the value of reflection-seismograph surveys was demonstrated and beginning in 1934 there was another sharp upswing in the discovery rate. The year 1938 appears to have been the end of the so-called geophysical world.

Since 1938 the search with the reflection seismograph has continued at a high rate as is evidenced by the number of units in operation, but the results obtained have been disappointing. It is reasonable to believe that the intense search to which the more promising petroliferous areas in this country have been subjected has left only a greatly reduced number of structures yet to be uncovered.

The underground accumulations of oil may be classed in two general groups; those which occur in traps formed by the up-dip wedging out of permeable beds, and those which occur in traps formed by folding or faulting or both. With few exceptions, all accumulations of oil may be grouped in one or the other of these types termed, respectively, stratigraphic traps and structural traps.

Exploration in the past has been largely directed to the search for structural traps. Practically all the industry's scientific and technical skill, from the standpoint of both the geologist and the geophysicist, has been engaged in finding anticlinal and domal structures. If reports received as to the size of structures now being found in our main petroliferous provinces and which will serve as the principal prospects for structural wildcat drilling in the next year or two are correct, we must look elsewhere to augment our declining discovery rate.



—Robert Yarnall Richie photo.

Intelligently directed exploratory effort is at an all-time high, for example in excess of 300 geophysical and core-drill crews are employed currently, but must go higher if diminishing rate of discovering oil is to be checked soon enough to assure adequate supply to meet growing consumption.

Most Intensive Stratigraphic Search

This suggests that the search for stratigraphic traps should be intensified. Most notable examples among this type of field discovered to date include East Texas, Burbank, Coalinga Deep, Kern River, Kern Front, and the shoe-string-sand pools of Kansas. At the same time the further exploration for structural-type accumulations should not abate. There are undoubtedly favorable structures yet to be found through a more detailed survey of portion of the presently-known petroliferous areas. Further examination of presently non-producing areas in search for favorable structures also probably will open up new producing fields. But it does not appear that such exploration alone will assure an adequate supply of petroleum for this war if it be a long war.

Exploration for stratigraphic traps will require the drilling of a greatly increased number of wildcat wells. Devices, such as the seismograph, have

served to locate the structural traps, and the test well has served the purpose of determining whether oil had accumulated within the trap. In locating stratigraphic traps, the test well must serve the dual purpose of both locating the trap and determining whether oil has accumulated therein. This will require a great deal of so-called "random" drilling.

It should not be inferred from the name that this type of drilling does not require sound judgment and careful study of known geological facts in selecting the locations. All available geological information should first be obtained for the prospective area and analyzed. If possible, there should be a determination of whether porous sediments suitable for oil accumulation underlie the area. The geological history of the area should be reviewed from that information which is already available to determine the probability of unconformities being existent in the underlying formations which might serve to form suitable traps. Where the needed information is not already available, it will be necessary to drill test wells, possibly slim holes or core tests, for this purpose. More than ordinary care should be maintained in examining and utilizing all the information thus obtained so that the number of tests necessary to discover a new oil field may be kept to a minimum.

New oil reserves must be found in increasing quantities if the war demands are to be adequately met one, two and three years from now. The time necessary for developing new discoveries and making the oil available requires that immediate attention be given to finding new prospects and prospective areas for development one and two years in the future. No single technique can be relied upon to find adequate quantities of oil. Every known method must be employed. New and improved uses of old techniques must be developed. Geological and geophysical data, previously obtained must be restudied and reappraised in the list of our most advanced knowledge of oil occurrence. And with all this the industry will need to do more wildcatting and take longer chances in wildcatting than has been customary in recent years.

An exploration program of this magnitude will require more materials, more manpower, and a greater expenditure of money.

Much of the material from which the technical equipment required in oil prospecting is made is in great demand by the armed forces. The quantities of such equipment required by the petroleum industry are relatively small, however, so there should not be substantial difficulty in filling such requirements. Although the petroleum administrator has called upon the industry to drill a minimum of 4500 wildcat wells in 1943, the amount of material needed for that number of test wells will be small when compared with the requirements for development drilling. In distributing the materials made available for petroleum production operations preference will be given to exploratory requirements. The supply of drilling rigs for wildcat drilling should not present a serious problem since the advent, December 23, 1941, of Conservation Order M-68 which reduced by 40 to 50 percent total drilling operations.

Manpower Serious Problem

Increased manpower requirements present a more serious problem. Most of our exploratory techniques require the services of highly trained technicians and scientists. Men with this type of training are also sorely needed by the armed services. As a result many of these men have been called from the industry to accept commissions with the armed services. The industry's ranks of skilled labor, essential in drilling operations, have been sadly depleted to fill the labor requirements of our war plants and factories. Recognition of the seriousness of these losses was given in a recent statement issued jointly by Paul V. McNutt, chairman of the War Manpower Commission, and Harold L. Ickes, Petroleum Administrator for War. In that release it was stated that "Oil and gas are vital to this war and it does not help to win the war for men who have long been trained and skilled in this industry to leave their jobs." Bulletins issued for the guidance of local draft boards and employers list 179 specific classes of jobs in the petroleum and natural-gas industry which are considered as essential activities. The Petroleum Industry War Council has set up a permanent committee for the specified purpose of studying and advising on manpower problems. Furthermore, the Petroleum Administration for War is maintaining a close liaison with the War Manpower Commission to provide that agency with a more thorough understanding of the industry's manpower problems. Despite these efforts the industry's labor problems will be critical at best. The men remaining in the industry will have to assume added duties and assist in the training of new men. Older men will have to be called upon to carry on the operations customarily assigned to the young men of the industry.

The general expansion of exploratory activities and the increased finding costs that will be associated with the search for stratigraphic-trap-type pools will necessitate a substantial increase in the funds made available for exploration. Under present conditions, venture money for wildcatting from sources outside the industry is likely to become increasingly rare. The obligation will fall in growing measure upon the industry itself. To more evenly spread these costs and reduce the amount of risk involved to any one individual or company, there is likely to be more of the old cooperative type of venture that was so common in the Mid-Continent during the twenties. When a prospect has been developed to the point that a test well is desirable, spreads of nearby acreage or percentage interests in the prospect will be sold to others in order to minimize the individual risk.

These increased expenditures on the part of producers raises the question of crude-oil price. Following the submission of a report by the Petroleum Industry War Council which recommends an increase in the crude-oil-price ceiling, the Petroleum Administration for War has been engaged in a thorough study of the matter so that appripriate recommendations can be made to the Office of Price Administration. In making this study we are vitally concerned with the costs of finding new oil, replacement costs, since one of the primary problems of the industry is that of finding new reserves in quantities adequate to maintain a productive capacity which will meet the rising war demands.

Continued consideration will be given by federal agencies to all appropriate means for encouraging and promoting the discovery of new oil. The individual companies are being approached for the purpose of discussing their oil prospects and proposed exploratory programs in view of the necessity for stepping up our oil-finding rate.

Conclusion

In conclusion I would like to emphasize that:

War and essential civilian consumption of petroleum may be expected to increase.

The current rate of finding oil is too low.

Our present crop of prospects is not encouraging in size or quality.

Without new discoveries our productive capacity will be inadequate by the end of the year.

All known means of exploration must be resorted to in increasing our finding rate.

Increased exploratory funds and more cooperative effort will be necessary on the part of the industry in order to balance discovery of oil with consumption and in order to maintain essential productive capacity.

Oil Men Vote Increased Crude Possible Stimulants

By L. J. LOGAN,

THE strongest possible stimulus to wildcatting, in the overwhelming opinion of the men who must put up the money and do the work, would be a general, substantial increase in crude-oil prices, which would make the drilling of wildcats at least potentially profitable when production was found. This opinion was voiced by the industry in a survey made by the editorial staff of this magazine on the question of possible wildcatting stimulants.

The opinion that a general crude-price advance would be the most effective possible stimulus to wildcatting was conclusively reflected in tabulating returns of the ballots employed in the survey; although the returns also revealed heavy emphasis by the industry on several other "possible stimulants" to exploratory work. Chief among the latter were dispelling of federal control fears by a favorable government attitude, freedom from changes in the industry's tax structures, adequate materials, manpower and some other factors. Federal government subsidies and entrance into the business drew heavy condemnation, although the ballots did not seek to determine opinion on "objectional suggestions."

Description of Survey

In conducting the survey of opinion, THE OIL WEEKLY mailed out printed ballots to companies and operators that drilled 15 or more wells in 1942 and also placed some ballots with additional outstanding wildcatters, drilling contractors, and others. Independent operators personally received and marked the ballots, and the ballot for each of the companies was directed to an executive or key official considered well and authoritatively qualified for expressing opinion for the company on the subject involved. Recipients of the ballots were asked to indicate thereon their opinion as to the importance of possible stimulants to exploratory work.

On the ballot were printed 10 "possible stimulants," and space was provided wherein the voter could also write in additional suggested stimulants. The voter was asked to rank these "possible stimulants" in the order of their importance, in his opinion, by writing a "1" before factor considered of first importance, "2" before factor of second most importance, "3" for next most importance, and so on.

In addition to the ranking of the different factors, the voters were invited to write on the backs of the ballots any comment they would make.

From these ballots, the accompanying tabulation has been compiled, for reflecting the opinion recorded by all the voters.

Inasmuch as there were 10 possible rankings of the "possible stimulants" on the printed ballot, while a few voters actually indicated choices all the way from 1 to 10, all choices were given specific values, graduated downward from 100 points for first choice to 10 points for 10th choice. If any "possible stimulant" was considered of first importance by the voter, it drew 100 points from that voter; and if it was considered by the voter as second in importance, it scored 90; while if it was voted 3rd or 4th or 5th in importance, it scored 80, 70, or 60 points, respectively. If it was accepted as 10th in importance it scored 10 points, but if it was crossed out on a ballot as undesirable or allowed to stand unmarked as being of no importance, it drew from that ballot no score at all. Actually, two of the "possible stimulants" drew numerous definite negative votes, while many voters indicated only several choices and thereby were assumed to have implied that they considered remaining "possible stimulants" as being of little or no importance.

Price Rated Foremost Factor

The proposition of an increase in crude prices far outranked any other "possible stimulant" to wildcatting. It drew 7 times as many first choices as the runner-up among factors ranked No. 1, and received more than twice as many No. 1 rankings as all other propositions together. On ballots where the crude price increase did not rank No. 1 it was given No. 2 rating in most cases, while drawing also several 3rd, 4th, 5th, and 8th choices. On the basis of grading values, higher crude prices scored nearly twice as many points as the second ranking possible stimulant.

While some voters qualified their endorsement of a crude price increase, none flatly objected to higher prices. One prominent oil company official stated: "This is a controversial matter, but one which I do not think would affect the situation very much one way or the other, although I am not against an increase in prices." Another voter ranked a crude raise as No. 1 stimulant "without regard to the possible effect upon inflation," which he said the government appeared unwilling to control firmly anyway. "Were the government to propound a firm policy as to wage increases, prices at the source, overtime pay, and so forth," he wrote, "we would naturally feel that an upward adjustment of crude prices would tend to upset the stability of any plan." Finally he concluded: "An upward adjustment of prices would provide the one stimulus that in the past has been so effective in promoting wildcat drilling."

Freedom from Fear

Second choice of the industry as necessary for stimulating wildcatting was, in effect, one of the Four Freedoms—freedom from fear. On the ballot, this was worded: "Proclamation of a sympathetic and reasonably long-range government policy with regard to wildcatting and development of new fields, which will dispel misgivings over controls and discretionary powers of administrative agencies." Several voters wrote on their ballots more or less equivalent propositions, covering the idea of relief from bureaucratic red tape, useless questionnaires, and statistics; and these were counted in with the mentioned "stimulant" printed on the ballot.

Despite the avalanche of voting for higher prices as the No. 1 prerequisite for increased wildcatting, there was along with every 7 votes for better price as the most needed stimulus, 1 first place vote for a sympathetic attitude of the government, which would quiet misgivings over restrictive controls. This possible stimulus was voted 2nd place by many who gave better price first place, and it scored heavily in 3rd place, while drawing votes also in nearly all other positions.

Besides being irked by increased re-

Prices as Most Important of To Wildcat Drilling

Associate Editor

strictions and red tape, the industry apparently is reluctant to undertake the long-term work which careful exploratory development requires because of the lack of confidence that governmental policies henceforth will be sympathetic and reasonably advantageous.

Depletion and Intangible Costs

Closely allied with the *favorable government policy* stimulus were two other propositions written in on ballots and given separate ranking in the accompanying table: (1) retention of the depletion allowance and deduction of intangible drilling costs in computing federal income taxes, and (2) decentralization of the Petroleum Administration for War, to expedite decisions and action.

Some voters declared that a favorable government policy necessarily should embrace the retention of the depletion allowance and the right to expense intangible drilling costs as they now stand in the income tax law; that the elimination or reduction of these allowances would badly cripple the industry, particularly with respect to exploration. Some asked for positive statements from the Treasury Department that it would drop its persistent demands for Congressional elimination of these allowances.

Depletion and intangible costs were not printed on the ballot but was written in on a considerable number of ballots and came out 9th in the scoring. If this tax matter had been printed in, it very likely would have ranked substantially higher. Some of those who wrote it in on their ballots gave it foremost importance. Many operators so fear the threatened elimination of the tax allowances that they will not even consider spending venture capital until they receive assurance that the tax provisions will not be altered.

Written in on several ballots and ranked high was the proposal of decentralizing and simplifying PAW as a

The Industry's Rating of Importance of Possible Stimulants to Wildcat Drilling, as Evidenced in The Oil Weekly's Survey of Opinion

Rank of Importance		1st Choice 100 Points per Vote	2nd Choice 90 Points per Vote	3rd Choice 80 Points per Vote	4th Choice 70 Points per Vote	5th Choice 60 Points per Vote	6th Choice 50 Points per Vote	7th Choice 40 Points per Vote	8th Choice 30 Points per Vote	9th Choice 20 Points per Vote	10th Choice 10 Points per Vote	All Choices 1st to 10th Total Points Scored
1	Upward adjustment of crude oil prices to provide more favorable relation between exploration and development costs and income from properties.	5,300	630	80	140	60	.....	.....	30	.....	.....	6,240
2	Proclamation of a sympathetic and reasonably long-range government policy with regard to wildcatting and development of new fields, which will dispel misgivings over controls and discretionary powers of administrative agencies. (Includes votes for elimination of bureaucratic red tape, useless questionnaires and statistics.)	800	990	880	280	240	150	240	60	.....	.....	3,640
3	Making materials and equipment more readily available than heretofore.	300	1,170	960	700	360	100	40	.....	.....	.....	3,630
4	More liberal daily allowables for new producing areas, toward the end of hastening pay-out of investment.	100	900	800	210	480	150	80	30	.....	10	2,760
5	Alleviation of existing or prospective shortage of manpower for carrying on exploratory and development work.	300	630	720	560	300	100	40	60	20	.....	2,730
6	Giving greater assurance of pipe lines or other market outlets for any production established.	.....	540	880	280	120	200	240	60	20	.....	2,340
7	Better results of exploration departments or exploration concerns in finding attractive prospects to drill.	500	540	240	140	.....	250	40	90	.....	.....	1,800
8	Elimination of prevailing automotive transportation difficulties by providing more adequate trucks, automobiles, tires, etc.	.....	.....	80	350	180	300	80	60	60	.....	1,110
*9	Retention of depletion allowance and deduction of intangible drilling costs in figuring income tax.	100	450	80	.....	.....	.....	.....	.....	.....	.....	630
*10	Decentralization and simplification of PAW, to expedite action. 90 percent of decisions now made in Washington should be made in district offices. Washington should determine policy and let district offices administer in line with these policies.	100	90	.....	.....	.....	.....	.....	.....	.....	.....	190
*11	Change in labor policy—make it possible for 3 crews to run rig continuously on a single well without double time.	.....	90	80	.....	.....	.....	.....	.....	.....	.....	170
†12	Government subsidies to aid in drilling of promising prospects.	.....	.....	.....	.....	60	.....	.....	.....	80	.....	140
*13	A change of policy on part of some companies, so that a more cooperative attitude would be taken in the area where known structures are owned by numerous companies, so that acreage or money would be donated towards the drilling of wells.	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	100
*14	Per well allowable and tax laws which will permit oil pool discoverer to realize return of his investment before application of income tax laws.	.....	.....	80	.....	.....	.....	.....	.....	.....	.....	80
†15	Setting up of a government owned and controlled operating company, to participate in active search for new fields.	.....	.....	.....	.....	.....	.....	.....	30	.....	40	70

* This proposition might have ranked higher if it had been included on printed ballot; it was written in on ballot by voters.

† Although **government subsidies** and **government operating company** scored some points in this tabulation, opinion was predominantly and definitely against both propositions, as evidenced by action of all but a few voters in declining to rank them; rating them 9th or 10th or last, "998" to "1000," or "0"; writing in "not necessary," "opposed," "no," or "never"; marking "X" or "Out" before them; or scratching them out. Besides **government operating company**, one voter wrote: "Why put this Joker in."

means of expediting and stimulating exploratory drilling. The criticism was offered that the Washington headquarters of PAW were overworked and too far removed to give wildcatters the prompt and sympathetic cooperation needed; that Washington should determine broad policies and leave to capable men in the 5 district offices the administration of such policies and actual contact with operators. This proposition ranked 10th as a possible stimulant to wildcatting, without having been printed in on the generally distributed ballot.

Making Materials Available

Rated 3rd in importance as necessary to stimulate wildcatting was the making of materials and equipment readily available. There is in effect a policy of providing materials and equipment in any required quantities for all wildcatting, and some voters stated that they had experienced no serious difficulty in obtaining their requirements. However, others indicated that materials and replacements actually were not available as readily as desirable, and that they feared sharply increased difficulty, inasmuch as operators, supply companies, and drilling contractors were approaching the limit of their ingenuity, hitherto resorted to, in getting by with equipment in their hands.

Some voters asserted that some provision would have to be made shortly to permit flow of materials and replacements to drilling sites or else all drilling would be seriously curtailed, in both proven and wildcat areas. Some suggested that it would be even more efficient for supplies of casing for wildcats to be carried by supply companies in stock at key points throughout the producing areas, this special pipe to be delivered only on specific orders. Such arrangement would require less national inventory than if each operator provided and maintained his own inventory for possible wildcat needs, he contended.

Manpower Problem

Closely allied with the problem of securing adequate materials and equipment in present wildcatting activity is that of sufficient trained manpower. The ballots and comments indicated that manpower had not yet become as important a problem as materials but that it was expected to become an acute problem in the early future, possibly overshadowing materials. Manpower shortage probably has not prevented the drilling of many wildcat wells, one man stated, but the industry must realize that it probably is the most serious problem that will have to be solved in the near future. The proposition of alleviating existing or prospective shortage of manpower for carrying on exploratory and development work lacked only a few points of ranking immediately after providing materials as a necessary stimulant to wildcatting, and it drew an equal number of first place choices. In total points scored, it ranked 5th, having been slightly outranked for 4th place by this "possible stimulant": "More liberal daily allowables for new producing areas, toward the end of hastening payout of investment."

Larger Allowables for New Areas

Rating of higher allowables for new producing areas as the 4th best stimulant for wildcatting was to some extent a plea for increased transportation outlet for new fields, inasmuch as low allowables in new fields are based in many instances on lack of normal market outlet under present dislocations in transportation. Consequently, there was nearly the same rating given to "higher allowables" and the proposition of "giving greater assurance of pipe lines or other market outlets for any production established," the latter having ranked 6th. Comments on the ballots and in letters sometimes covered both propositions together.

The operators consider the present circumstances and decide that it is impractical to bring in new pools merely to be shut in or to further curtail production from adjacent areas already practically shut down. As to the desire for "more liberal allowables," the operators further cannot see how such wildcatting could result in higher allowables, as the present allowables cannot be marketed.

From the comments along these lines, it is indicated that there will be a substantial stimulus to wildcatting if and when PAW's activities in expanding transportation reach the stage of providing ready market outlet for the older as well as new fields of southern and western Texas and New Mexico, which districts offer the best possibilities of furnishing important new sources of oil.

Need for Better Prospects

A highly significant result of the survey was the relatively low rating given by the industry to the need for better prospects as a possible stimulus to wildcatting, the implication being that prospecting is retarded by more important impediments than the lack of promising prospects. Need for better prospects was ranked 7th in the voting as a whole, although it received some votes as the most important necessary stimulus. Some voters in their comments broadened this item to include the need for improved oil finding techniques as prerequisite to the finding of larger numbers of attractive prospects on which to drill. One major company man wrote: "The crying need is for improvement in finding technique."

The ballots indicated that automotive and truck transportation difficulties were considered only a minor obstacle to wildcatting, their elimination having been ranked 8th among the possible stimulants. "This situation is Okay at present," one voter wrote in on his ballot beside this item, and by their rankings, other voters generally confirmed his statement.

Besides the proposals for retention of the advantageous features of the income tax law and the decentralization of PAW, several other suggested solutions to the need for more wildcatting were written in on the ballots, and those which were not closely equivalent to propositions on the printed ballot are included on the accompanying tabulation of results of the survey.

Oppose Federal Subsidies

Left until last to be commented upon here are two "possible stimulants" to wildcatting, included on the printed ballot but virtually buried under an avalanche of negative votes and scratchings-out, to which many voters resorted instead of dignifying the propositions with rankings. One of these "possible stimulants" was "Government subsidies to aid in drilling of promising prospects." The other was "Setting up of a government owned and controlled operating company, to participate in active search for new fields." Typical of the general reaction to these proposals was this comment on a ballot: "I am scratching (these) the last two stimulants on this list. I would not include them in any classification. Certainly they would go last, and they don't deserve to be ranked "9" and "10." (There were but 10 "possible stimulants" on the printed ballot.) Many voters simply declined to rank these proposals, implying that they did not consider them as possible remedies, and in the few exceptional cases where they were ranked, they were given low rank. One ballot rated them "998" and "999" as possible stimulants and another as "999" and "1000." Some voters rated them "0." One wrote in "not necessary." Several wrote in "opposed." In numerous cases, the voters wrote in "no" or "never," or "X" or "Out." On a considerable number of ballots both items were scratched out or typed over with X's. One man wrote in beside the government operating company proposal, "Why put this Joker in a list of otherwise fairly intelligent factors?" Concerning the two items, one oil company executive wrote: "In my judgment they suggest governmental activities which are and should be unthinkable, and which would be ill-advised from the interest of government and the oil industry." That this view was shared fully by practically the whole industry was made clear by the survey.

COMMENTS RECEIVED FROM OIL MEN ON STIMULANTS NEEDED TO ENCOURAGE WILDCATTING

Many of the ballots returned in this survey were accompanied by comments of voters. Presented herewith are those that had no objections to having their views published. Others made comments, but requested that their thoughts not be made public for various reasons. The ideas expressed by the latter group of oil men were similar to the views presented in the following letters, for the most part dealing with prices, manpower, taxes, materials and red tape.

Adequate Prices Needed to Offset High Costs and Wildcatting Risks

We are of the opinion that the average independent operator is more concerned with a reasonable price adjustment to bring receipts into line with the increased cost of doing business than with the problems of restriction brought on by the war. Patriotic and ambitious though he may be, he cannot reconcile himself to financial suicide by continuing a program of wildcatting while costs remain all out of proportion to returns, particularly when returns are speculative in the extreme as in the case of exploratory wells. A proper price adjustment will change the whole picture.

TYSON CLEARY, *Auditor,*
THOS. D. HUMPHREY,
Dallas, Texas.

Past Method Best: Raise Price

Experience has proven that the past method of discovering oil is the best, all that is needed is a higher price of oil.

H. R. CULLEN,
Independent Operator,
Houston, Texas.

Declining Efficiency of Labor Runs Costs Up; Need Depletion Allowance

Flat increase in price of crude is believed most important factor.

Skilled labor for the oil industry is being rapidly drained, and cost of development is increasing to the point where drilling generally, but especially of deep wells, through inefficiency of labor is becoming prohibitive. It is most important that the government give assurance that the depletion allowance of 27½ percent will remain unchanged for the duration and after.

F. JULIUS FOHS, *Pres.,*
FOHS OIL COMPANY,
Houston, Texas.

Control by Majors Alleged

Curb control by majors which is closing in now rapidly—selective buying, pipe line proration, taking advantage of "war" necessities as indistinguishable by the general public. Look into profits being made by integrated companies, making it possible to pinch the little fellow on the one hand with the other.

G. A. C. HALFF, *Pres.,*
BLANCO OIL COMPANY,
San Antonio, Texas.

Other Considerations Secondary to Price

Crude oil prices are below any other commodity. There is no incentive today for wildcatting in view of small allowables and low prices. Thousands of small wells are being abandoned. Unless there is price adjustment upward, we may face another situation like rubber shortage. All other considerations are secondary to price incentive.

W. S. HALLANAN, *Pres.,*
PLYMOUTH OIL CO.,
Pittsburgh, Penna.

Let Price Govern Supply

I believe in free enterprise wherein supply and demand govern prices and amount of production.

ERLE P. HALLIBURTON, *Pres.,*
ERLE P. HALLIBURTON, INC.,
Duncan, Oklahoma.

Repair Parts Are Bottleneck In Industry's Transportation

Greater assurance of pipe lines or other market outlets for production not considered important in Illinois because we have had excellent cooperation from purchasing companies.

The bottleneck in the matter of prevailing automotive transportation difficulties is "repair parts."

The item of more liberal daily allowables for new producing areas is probably very important in prorated areas.

LEO. V. HORTON,
Consulting Geologist,
Mt. Vernon, Illinois.

Needs Are Higher Crude Price, Materials, Cutting of Red Tape

There is nothing the matter with the oil business except too much government regulation by certain interests that care nothing about the public or government but want to control the situation and they are making plenty of money as it is controlled by them through PAW and OPA.

There will be plenty of wildcatting if the OPA and PAW will give us a price on crude on parity with all other commodities on the market and this would mean almost double the price we are now getting for crude and also give us the necessary materials to do the work and cut the most of the red tape now connected with handling the business. There is no excuse for the situation that exists today. The OPA allows all commodities to increase price but why has the price of crude been held where it is. I just noticed today here in Fort Worth that all fresh vegetables have gone up 10 cents to 12 cents a pound above the price yesterday and they were out of reason before. The most of us independents have become convinced that certain interests in control under Ickes and Brown don't want a raise in price of crude.

C. F. KELSEY,
Fort Worth, Texas.

To Get Enough Oil, Allow Prices That Make Wildcatting Profitable

There is but one thing needed to stimulate wildcatting, and that is an increase in the price which will justify it. Production and drilling costs have almost doubled in the last year. Not only have wages gone up, but efficiency has gone down, and at the present price, the independent does not yield enough surplus to have the money available out of production for wildcatting. The only justification for the independent wildcatter at this time is when he can find some outside money that has been earned other than in oil.

The oil industry has in the past kept production equal to the demands. This has been done by raising and lowering the price from time to time, and I know of no other effective methods.

To give government subsidies means the elimination of the honest wildcatter and turning it over to the promoters and the grafters. Setting up the government-owned and controlled operating company would mean the elimination of all the independent wildcatters and would result in the finding of very little oil. We must remember that some of our greatest pools were found because the "ignorant independent" drilled where the "wise boys" condemned.

I have, perhaps, drilled as many wildcat wells as any independent in the state, and I have opened up numerous oil pools, but under the present price of crude, I do not feel justified in continuing my activities except where I can get outside money. The increase in the allowable is not the answer. Most of us are producing all the oil, we think, that can be produced at this time, and the great majority of pools are producing all the oil they can.

Personally, I have not experienced any difficulty in getting supplies or manpower. All we have to do to keep an abundant supply of oil is to allow the price to advance to a point where the business will be profitable.

O. W. KILLAM,
Independent Operator,
Laredo, Texas.

Need Price to Attract Risk Money

An adequate price which will provide some risk money is a prime mover in stimulating wildcatting. It will automatically solve most of the other problems which now beset the wildcatter, and should be a matter for first consideration by both the government and the oil industry.

A. I. LEVORSEN,
Consulting Geologist,
Tulsa, Oklahoma.

Too Much Centralized Control

There is too much centralized federal control. Local problems are not understood. Far too long a time elapses in getting answers.

WARD S. MERRICK, *V. P.,*
F. W. MERRICK, INC.,
Ardmore, Oklahoma.

More Authority Needed in District Offices of PAW to Avoid Delays

It has been my privilege to serve for the past 18 months as a member of the Transportation Committee for District Three, and as chairman of two subcommittees doing special work. During this period I have observed closely the policies of the PAW. I have come to the very definite opinion that the principal criticism of PAW is delay.

I am convinced that the Washington staff of PAW are capable, conscien-

tious, and are working long hours in their respective jobs. I think that too many decisions are attempted in Washington. The present flow over their desks naturally blocks the traffic and things of relatively little importance block the way for decisions on important projects.

I am of the opinion that this can be corrected by decentralization and simplification. I think Washington should set the policies and the five district offices of PAW should administer in accordance with those policies. Nothing should go to Washington that is covered by an established policy. Decisions on this policy should be made at the district office. Only those things involving new policies on hairline decisions should find their way to Washington.

A director in a district office drawing $6500.00 per year, which I admit is much less than he is worth, makes a recommendation, and it is passed on by a clerk in Washington drawing $3200.00 per year. Certainly that is not sound.

I am of the opinion that if decisions on all drilling matters (in the Houston region) were made in the Houston office, where they certainly could be handled in two or three days, that would be the greatest possible stimulant to wildcatting. If a poor boy wildcatter wants to go into the district office and find out what is necessary for him to have the equipment for a wildcat, it would be explained to him in detail, his application for surface pipe filled out and okayed while he was present.

That kind of policy would put the poor boy wildcatter back to work. At present he is flabbergasted by the red tape, thus eliminating him from a very important part of the war work.

MASTON NIXON, *Mgr.*,
SOUTHERN MINERALS CORP.,
Corpus Christi, Texas.

For Wildcatting We Must Have the 3 M's—Money, Manpower, Material

There is no mystery about wildcatting. We must have the money—manpower—and material—"The 3 M's."

This system has worked since oil was discovered. Why should it fail now?

Protect the producer—first of all—whether he produces crude oil, timber, eggs, milk wheat, or what not. Wreck the producer, which is rapidly being done, and you'll have nothing to regulate. One of two things will happen. All production will fall into a few hands capable of regulating itself in its own way, or production of basic commodities will dwindle to a low ebb.

By all means—for the good of America—protect the producer.

NEVILLE G. PENROSE, *Pres.*,
NEVILLE G. PENROSE, INC.,
Fort Worth, Texas.

Independent Needs Cooperation of Larger Companies in Exploration

It is a well known fact that a great majority of the wildcat wells which are drilled in this country are drilled by independents. The larger companies are not supporting the drilling program heretofore carried on by the independents. They are not helping drill wildcats by the donation of acreage, nor by the donation of money. In nearly all known geological and geophysical tracts, the acreage is held by more than one company, and unless these companies help the independent in his drilling campaign, the wildcatting program will lag.

I have suggested to PAW that stocks of casing and tubing be carried at certain specific points, such as Memphis, Houston, New Orleans, some point in Oklahoma, some point in Kansas, and the Pacific Coast, and in Illinois, and that these stocks be ear-marked for exploratory wells only, and that whenever an exploratory well is started, that it be given an exploratory preference rating. The operator could then commence his drilling after he had secured the delivery on his surface pipe, knowing that if he ran into an oil and gas field which indicated possibilities of production, his oil string and tubing would not be more than 48 hours away.

It is a waste of rubber and money to cart a string of casing and tubing to a location when it is not known that oil will be discovered, or the pipe used. The moving of this pipe around from one wildcat well to another is also injurious to the pipe.

A. H. ROWAN,
Fort Worth, Texas.

Spacing Rules too Strict; Market For Sour Crude Would Add Fields

One of the handicaps to the average operator developing in shallow areas is the 40-acre spacing rule by the federal government. There are many areas where this rule could be lifted where production usually is found at a depth of 2500 feet, which is now considered shallow drilling. Many of our fields in Texas today have a set pattern of from 10-acre spacing to 20-acre spacing.

Recently the Railroad Commission further approved this spacing, but we have not been able to obtain permits from the federal control agency to permit the drilling on less than 40-acre spacing even to protect drainage from offset wells. If this ruling could be lifted to even 20-acre spacing, there would be a number of additional outpost wells drilled in shallow areas, thereby providing information in reference to known reserves. In many shallow areas, any well drilled 990 feet away, under present ruling, is a wildcat, and if the federal government would cooperate with the Railroad Commission and reduce this spacing to 660 feet, it is the writer's opinion that many additional shallow wells would be drilled which would either prove or disprove the limits of the productive area.

I would also recommend that the federal government grant the priorities and insist that the material granted in said priorities be delivered to different refineries for desulphuring West Texas sour crude. With the extreme low allowable for sour crude in West Texas, there is no incentive whatsoever for a wildcatter to drill a well in West Texas and then find that he has been prorated by the pipe line to where the payout would not be attractive.

F. H. SCOTT, *President*,
F. H. SCOTT COMPANY,
Fort Worth, Texas.

Larger Allowables Would Cause Loss of Oil in Some Fields

I am opposed to government control and supervision of any private industry.

I would not approve of government subsidies on individual or corporation owned property. It might be advantageous for the operator and the government where the government owns the land.

In regard to more liberal daily allowables—I don't know what good larger allowables would do in other areas, but for East Texas it would result in immeasurable loss to take oil much faster from the East Texas Field.

M. C. SELLS, *Pres.*,
SELLS PETROLEUM, INC.,
Gladewater, Texas.

High Costs and Taxes Prevent Wildcatting by Independents

I am convinced that an increase in the price of oil is the only thing that the independent needs to stimulate his activities in wildcatting. We are all so broke due to high cost of labor, materials and high taxes that we cannot do anything under the present price rule.

FRED W. SHIELD, *Pres.*,
SHIELD OIL COMPANY,
San Antonio, Texas.

Price Raise and Tax Relief Would Stimulate Drilling, Save Old Wells

I would like to make the following comments on the steps necessary towards solving the critical crude oil shortage which must take place at a reasonably early date unless something is done to increase the ability to produce more oil when needed.

Number One on the list is an increase in price paid for crude which will have a three-fold effect. First, it will retard the abandonment of those wells which are now unprofitable to operate. Second, it will permit the development by secondary recovery of those areas which can not now be profitably repressured; and third, it will provide a profit incentive for wildcatting.

Number Two, a statement by the Treasury Department that it will discontinue fight for elimination of depletion allowance and issue an assuring statement that it will be continued.

Number Three, a per well allowable and a tax law which will permit the discoverer of a new pool to realize the return of his investment before the application of the Income Tax laws.

The setting up of a government owned and controlled operating company to participate in active search for new fields, government subsidies, or the requirement of approval by any governmental agency of any prospect before drilling can only have a harmful and retarding effect.

The only reason for anyone wasting his capital in wildcatting under present uncertainties is one of patriotism, and unfortunately, due to optimistic statements by those prominent in both government and the armed forces to the effect that "this war will be over in 1943 if we all pull together," the average citizen does not believe that sacrifice is necessary to win this war. The facts are that barring an internal collapse of Germany, or a shortage of some critical raw material, this will be a long war and a costly one in every way. With the present general attitude, however, towards the length of the war, and the Treasury's attitude towards the depletion allowance, the average oil producer can well wonder why he is not better off to invest his money in common stock of those companies which are operating on a cost-plus basis and which are bound to show a profit, rather than risk it in wildcatting when the chances of his obtaining return of capital is 25 to 1 against him, and when he does "hit" the present tax law may take his entire profits.

R. T. ZOOK, *Pres.*,
THE SLOAN AND ZOOK CO.,
Bradford, Pennsylvania.

Failure of discovery rate to keep pace with production presages inability of industry to meet growing war requirements. Large areas have new field possibilities, but wildcatting must be stimulated to find them fast enough

New Oil Reserves Must Be Found

By ALEXANDER DEUSSEN, Consulting Geologist

THE adequacy of our future oil supply at the moment appears ominous.

As with the other major products of our economy, we suddenly find ourselves in a situation from one of superabundance to one of critical shortage. A decade ago we paid farmers to shoot their cattle in the pastures and bury them in trenches—today we are clamoring for meat. Ten years ago, we did not know what to do with our large oil supply—today we are concerned with the question of being able to meet our war demand.

For the immediate future we probably have enough oil in hand to meet requirements, but as the war demand continues to accelerate, we will probably face a shortage by the end of this year, and if the war continues through 1944 and 1945, as it well may, we will face an acute situation.

Discoveries Declining

The occasion for alarm is that our discovery rate is not keeping pace with our production. As a matter of fact, instead of keeping pace with it, it is declining to an uncomfortable degree, and unless this condition is corrected the chances are that at some time in the not too distant future, we will be forced to depend on a source of energy other than our own domestic crude-oil supply.

Of course, the geologist well knows that some day—he does not as yet know when—the peak of production of our domestic supply will be reached, and thereafter production will gradually decline until this oil is all exhausted. The discovery of each new field means always just one less source from which oil can be drawn. The time will come when there will remain no new fields to be discovered in this country, though unquestionably that time is as yet far distant in the future.

The past year was particularly disappointing from the standpoint of uncovering sources of new supply. According to the recent report of American Petroleum Institute, the oil discovered in new fields amounted to only 260,051,000 barrels as against a production of 1,385,479,000 barrels.

These figures, however, do not correctly portray the whole of the truth, because actually the new oil included in our inventory at the end of the year as against the inventory of the year preceding was 1,878,976,000 barrels, because additional information in regard to oil previously discovered indicated that we must add some 1,618,925,000 barrels to the figure of the reserves of fields previously discovered.

And, as a matter of fact, this repeats the history of our discovery effort from year to year, as is pointed out in the American Petroleum Institute report. We never can tell at the end of the year exactly how much new oil we have discovered during the year, as the information on a new field, often with only one well in it, is never sufficient to justify assigning to such a field a new oil supply which later drilling may show, and often does show, a supply greatly in excess of the oil that could be assigned to it at the end of the year on the basis of information then existing.

It always takes a period of several years before we know how much oil we have discovered when an oil well is completed in a new producing area. For example, when C. M. "Dad" Joiner first completed the discovery well of the East Texas field, no one could know, or did know, or would be bold enough to assert, that by this well some 5,000,000,000 barrels of new oil had been uncovered.

These facts are clearly brought out in the table presented in the American Petroleum Institute report, which shows that the revision of reserves from year to year is more important in adding to our inventory at the year end, than the amount of new oil actually assigned to wells in new fields. The table is reproduced herewith.

Likewise, it will probably be true that in the future when we know more about the fields discovered in 1942 we will find that we have actually uncovered more oil than this record indicates.

Nevertheless, the record of 1942 is one that is not reassuring, as a glance at the column of "New Pools Discovered During the Year" will show, there is a more or less steady decline from 1937 with 928,742,000 barrels to the minimum of 260,051,000 barrels in 1942. We could feel more secure if we knew that the fields discovered are actually of major character rather than of the medium or moderate character now indicated for them.

Our finding rate is diminishing. Each year oil becomes more difficult to find and correspondingly requires more effort and more money to find the oil necessary to replace the oil currently produced.

Geophysics gave an impetus to discovery, but the effectiveness of this new aid has now almost reached its limit. We have as yet found nothing to take its place.

More Wildcatting Essential

It is highly essential at this time that wildcatting be stimulated and expanded to the greatest possible extent. It takes wildcat wells to find new oil, and prospects and areas must be drilled, even though at the moment it might appear that the basis on which they are drilled might be slender indeed. Often a wildcat well, in itself a dry hole, discloses important information that later leads to the discovery of a new field.

With the introduction of geophysics,

and the increasing cost of drilling wildcat wells, the tendency has been during recent years for wildcatting to become a major company operation, and of course it is essential that the larger companies continue with these activities, as they own most of the prospects concerning which geophysical information is available.

Need Small Operators

However, in the past the wildcat operator, with little or no money, drilling random wells which the larger companies would be afraid to risk, have been instrumental in finding much of our oil. His stimulus has been the hope of quickly realizing a large reward. Most often he failed, but every once in a while he succeeded in making a new and important discovery that opened up entire new provinces for exploration.

To illustrate, I need only mention Dad Joiner, who discovered the East Texas field with 5,000,000,000 barrels of oil; George Strake, who discovered Conroe and with it 600,000,000 barrels of oil; and at an earlier period Colonel Humphreys, who discovered Mexia, and opened up the entire Balcones fault play; Edgar B. Davis, who discovered Luling and opened up the Edwards lime play; and Frank Pickrell and his associates, who discovered Big Lake in Reagan County and opened up the entire West Texas play; and hosts of others.

Not one of these was a major company operator. They drilled wells that the larger companies were unwilling to risk, and in so doing added millions of dollars of new wealth to our country from which all of the people have benefited.

While this type of operator has to a large extent passed out of the picture, due to changing conditions, he is not entirely gone, and to my mind it is highly important to get him back into action, as much of the new oil that we need to find must and will come from this type of random drilling.

There is unquestionably new oil to be discovered in Texas and elsewhere, once we embark on an active period of wildcat exploration.

There yet remain a number of geophysical prospects that will eventually materialize into oil fields. Some of these have been tested dry and others are as yet undrilled. Of those that have been tested, nudoubtedly re-examination and further drilling will result in new discoveries.

The piercement-type domes, which have been with us for a long time, hold possibilities for new production.

Deep drilling in such fields as Conroe and possibly Tomball, Katy and others of this type, should yield new oil.

In many Gulf Coast counties we have not yet reached the limit of density for oil fields. New fields unquestionably lie between the present fields, which have as yet eluded the technique of the geophysicist, and the drill.

In East Texas and north of the Coastal Belt, Lower Cretaceous horizons and possibly deeper zones in certain areas, unquestionably offer opportunities for the discovery of new fields.

The Wilcox along the inner margin of the Gulf Coast probably likewise contains oil in a number of fields as yet undiscovered.

In the lower Coast the Vicksburg still offers abundant opportunities, and somewhere in this area stratigraphic trap types of oil fields also may await discovery.

Shallow Gulf waters adjacent to the Coast offer opportunities for Miocene production, although the expense and hazards of this type of drilling are not calculated to encourage an active campaign as long as land areas are still available for exploration.

In West Texas unquestionably are still abundant opportunities for the discovery of new fields.

Mississippi, Alabama and probably Florida should also turn up with new fields, if the exploration effort in these areas is stepped up to a sufficient tempo.

I can hardly speak with authority concerning the other oil-producing states, but certainly California has not reached the end of discovery, and Oklahoma and Kansas, and possibly other states in the Mid-Continent and west should likewise contain oil fields as yet not tapped by the drill.

What is most urgently needed at this time is an intense wildcat campaign in Texas and Louisiana, the most promising areas for new oil, however, not neglecting a considerable amount of similar activity in Oklahoma, Kansas and California, and to a lesser degree in Mississippi, Alabama and Florida.

Price Increase Urgent

It is extremely doubtful, however, that the wildcatter and the operating companies will be attracted to these hazardous ventures as long as the present governmental policies persist. An increase in the price of oil is most urgently needed if our present reserve situation is to be corrected at any time in the near future.

In the last World War, we also faced a critical situation as to our crude-oil supply. We let the price go to $3.00 per barrel, and as a result by the close of the war and shortly thereafter we found ourselves with an over-abundant supply. I have the conviction that a similar stimulus at this time would be equally fruitful of results.

In the longer view, it likewise appears necessary that our nationals must be encouraged to develop the oil resources of Mexico and countries of South America, so that when our domestic supply does fail, we will have a nearby source of crude to which to turn. I have little confidence that the Mexicans and the other Latin Americans at this time possess the know-how of finding the new oil supplies that exist in these countries. I have the conviction it will take American ingenuity to discover these resources, if they are to be found, and it would be well for our government to arrange some satisfactory basis with these countries, fair to the respective peoples, that would permit and encourage exploration by our nationals. Mexico probably has abundant reserves of oil just south of our border, easily available for transport to this country during the present emergency and without resort to tanker transportation.

Summary of Committee's Annual Reports Covering Period 1937-1942*

(Barrels of 42 U. S. Gallons)

YEAR	NEW OIL BLOCKED OUT DURING YEAR			Production During Year	Estimated Proved Reserves as of End of Year
	Through Revisions of Previous Estimates and Extensions to Known Fields	Through New Pools Discovered During Year	Total Through New Discoveries, Extensions and Revisions		
1936					13,063,400,000
1937	2,792,790,000	928,742,000	3,721,532,000	1,277,664,000	15,507,268,000
1938	2,243,571,000	810,493,000	3,054,064,000	1,213,186,000	17,348,146,000
1939	2,058,455,000	340,667,000	2,399,122,000	1,264,256,000	18,483,012,000
1940	1,607,012,000	286,338,000	1,893,350,000	1,351,847,000	19,024,515,000
1941	1,538,989,000	429,974,000	1,968,963,000	1,404,182,000	19,589,296,000
1942	1,618,925,000	260,051,000	1,878,976,000	1,385,479,000	20,082,793,000

* American Petroleum Institute Report of New Petroleum Reserves Found in 1942. Released February 27, 1943.

Geophysical Operations at Peak Levels During 1942

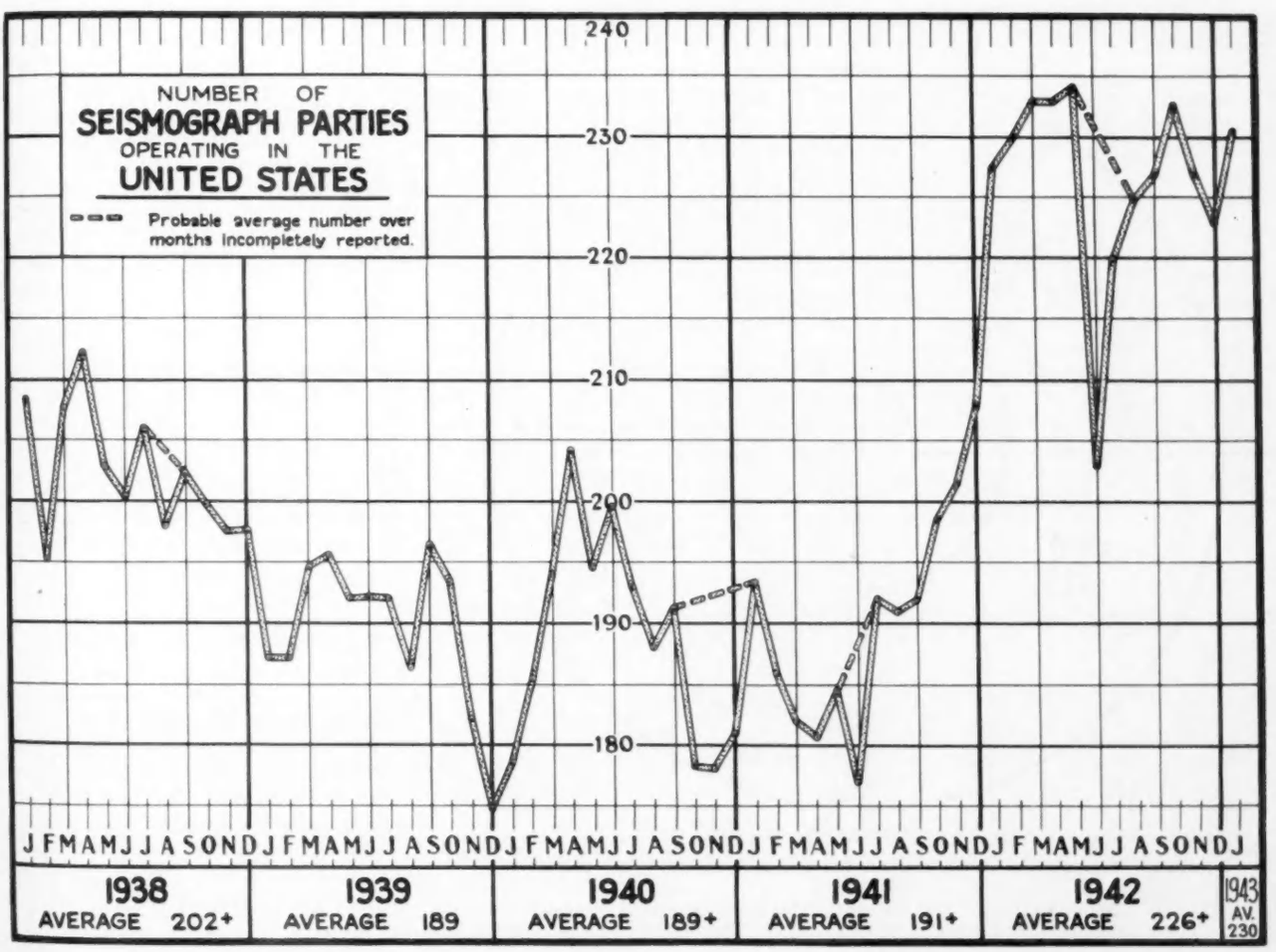
By E. A. ECKHARDT
Vice President, Gulf Research & Development Company

Wildcat program for 1943 demands increased rate of activity, but a severe shortage of experienced men indicates such expansion unlikely to be realized

THE high level of geophysical activity attained at the close of 1941 and the beginning of 1942 was well maintained during the year. In the early months of 1943 operations are running above the average for the preceding year. Since the Petroleum Administrator for War has asked the petroleum industry to drill 4500 wildcat wells during 1943, almost 50 percent more than were ever before drilled during one year, the need for expanded geophysical service is correspondingly great. The requirements of the oil industry therefore indicate that for the year ahead an increase of geophysical operations at least equal to that which occurred a year ago is demanded. It now seems very unlikely, however, that any such expansion can be realized.

The very nature of geophysical field operations makes physical fitness a necessary qualification for such work. Practically all men so engaged are excellent material for the armed services, not only physically, but also because of the character of their occupational experience. In fact, if allowance is made for the difference in objective and equipment, the operations of a geophysical field party are quite comparable to those

FIGURE 1


NUMBER OF
SEISMOGRAPH PARTIES
OPERATING IN THE
UNITED STATES
Probable average number over months incompletely reported.
240
230
220
210
200
190
180
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J
1938 AVERAGE 202+
1939 AVERAGE 189
1940 AVERAGE 189+
1941 AVERAGE 191+
1942 AVERAGE 226+
1943 AV. 230

of a mechanized army unit of similar size engaged in field maneuvers. With but minor exceptions, men disqualified for military service are equally unsuited for geophysical field operations.

Up to the present only the men who are qualified for their geophysical duties by many years of training and experience have been eligible for occupational deferment. This covers only from 15 to 20 percent of the personnel. On the extent to which these and the others can be retained will depend the degree to which the Petroleum Administrator's demands can be met. In any event, the geophysical effort will probably fail to register the expansion indicated as necessary. If the personnel losses yet to be faced are heavy, operations will actually fall well below their present level.

While no published data are available, it is known that the personnel losses of some geophysical operators to the Army, Navy and their civilian technical services run as high as 40 percent and that any further losses will necessarily result in curtailment of the service which can be rendered. The most baffling personnel problem is posed by irreplaceable key men who strongly desire a fighting part in the war, regardless of what any one else may think as to where they can serve their country best.

Activities Up 18 Percent

During 1942 an average of 226 seismograph parties were reported as operating in the United States. This is 35 more parties than 1941, an increase of 18.3 percent. The graph shown as Figure 1 covers the fluctuations in the number of parties over the past five years. At certain times the reports were known to be incomplete and the dotted portions of the fluctuation graph were judiciously drawn in to indicate the more probable situation. The precipitous drop in parties reported for June, 1942, and lower values for the months immediately following are almost certainly due to a temporary breakdown in the reporting system rather than a real decline in the parties operating.

As in previous years, Texas led all other states by a very considerable margin in the volume of seismograph activity, 42 percent of all reported seismograph operations falling within this state. This state also made the most substantial contribution to the proven reserves discovered during 1942, as reported by PAW. On the conservative estimate basis, its 1942 contribution to new reserves was 40.1 percent of the total. On the possible maximum basis it was 35.3 percent. The reserves discovered were therefore roughly proportional to the geophysical effort. Second only to the seismograph in volume of activity, the average number of gravimeter parties in 1942 was 58.8 as against an average of 54 for 1941, an increase of about 9 percent.

The circular chart, Figure 2, shows the distribution of geophysical parties by type and the geographical distribution of each type on the average during 1942. The number of seismograph parties in Texas during 1942 averaged 95.6 as against 75 in 1941. In Louisiana the number was 27.4, decrease of 2 parties from the 29.4 reported for the preceding year. In Oklahoma the 1942 average was 25.3, down 2 parties from the 27.2 average of 1941. In California the trend was up, the 1942 average being 20.3 as against a 14.9 average for 1941.

Petroleum Administrator Ickes has reported that since 1938 the industry has in no year discovered new reserves equallying in volume the crude-oil consumed in that year. This is true in spite of the most intensive effort by the industry to discover new reserves. To the geophysicist this is a challenge, but one which finds him in a rather helpless position. Geophysical research has of necessity been adjourned for the duration and personnel previously engaged in it has turned its attention to war research and development. There are those who have hoped that out of this activity might emerge a fresh impetus for radical new approaches to the exploration problem much as the techniques now in general use were more or less directly stimulated by the researches of World War I. It may now be too early to judge whether such a prospect does exist, but it can be stated that none is evident up to now.

The problem of supplying geophysical parties turned out to be less serious than was generally anticipated. The securing of supplies has involved a great deal of effort and was beset with exasperating delays, but ultimately the material usually became available. A definitely lowered efficiency inevitably resulted from these conditions, in line with the general experience that more units of effort are now required per unit of achievement.

The source of the greatest uncertainty in planning for the geophysical operations of the next year is the manpower problem. If these operations are to continue at a level necessary to accomplish the effective drilling of 4500 wildcat wells in 1943, some new provision will be required to assure the operators the required minimum of personnel. Without such provision, the geophysicists can hardly hope to do the job expected of them.

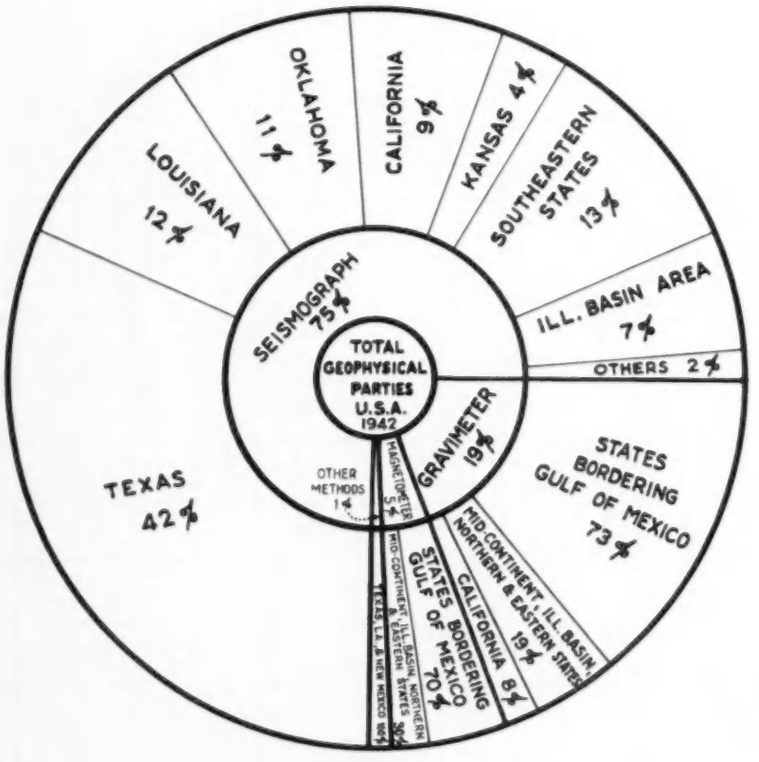


FIGURE 2
Distribution of geophysical parties by type, and geographical distribution of each type during 1942.

Oil-Supply Problem Demands Early Solution

By SYLVAIN J. PIRSON
Associate Professor of Petroleum and Natural Gas
The Pennsylvania State College, State College, Pennsylvania

Rising military requirements in the face of diminishing discovery rates have made the situation so serious that steps, even drastic ones, must be taken now. Tomorrow may be too late, as fruits of a wildcatting campaign are reaped with a delay of one to three years. Failure to solve the problem of oil sufficiency would constitute another major blunder of war management.

This article discusses both the supply and prospecting phases, and makes some pertinent recommendations and comments relative to encouragement of the gambling spirit in the wildcatter, technical aspects of looking for oil today, and other factors.

ONE of the main problems presently confronting the American oil business is that of maintaining known unproduced supplies adequate for all eventualities, both short term and long term, as well as their proper geographical distribution. This problem has not been created by the war, although participation of the United States in active hostilities has aggravated it to the critical stage.

The problem of oil reserves was realized almost from the creation of the Office of the Petroleum Coordinator when the Division of Reserves was established under the direction of E. DeGolyer to be replaced later by W. B. Heroy when the former became assistant deputy oil coordinator. Both men have repeatedly warned the nation of the alarming low rate of our present day oil discoveries.[1,2] From other high quarters similar warnings were issued.

Former Representative W. P. Cole, Jr., in his letter to President Roosevelt on October 22, 1942, summarizing the work of his committee on petroleum investigations, expressed in forceful words his appreciation of the situation when he said, "We are certainly headed towards disaster, Mr. President, if we cannot make provision at this time for an increased supply of nearby petroleum." From another source, the Petroleum Industry War Council's annual report, we have the following statement: "New oil reserves are needed at once and studies by PIWC and others are being made now to determine what incentives ought to be granted to encourage new discoveries of oil."

Historical Facts

In order to grasp the problem in its entirety let us first look at the historical developments which have made of the American oil business "a colossus with feet of clay."

In Table 1 are included a number of figures which are illuminating with respect to the present status of the oil-reserve problem. In column I are given the total number of wells drilled in the United States; they represent a measure of field activity in all phases: development of oil and gas properties, exploration wells, dry holes, deepening of wells, etc. In column II, the total number of exploratory wells drilled is indicated, which is a measure of the effort expended in discovering new supplies. It can be seen that in later years about 10 percent of all wells drilled are of an exploratory nature or wildcats. Of these only a fraction discovers a new field and thereby contribute to the increase of reserves. As seen from column III, this fraction is also approximately equal to 10 percent and therefore, about one new field is discovered for every 100 wells drilled. This, however, does not give a clear picture of the success of exploratory drilling as development wells drilled in known fields should not be included. In column IV, the number of new oil fields discovered are indicated. It is to be noted that the difference between these figures and those of column III accounts for the fact that some wells find only gas whereas one given pool may be discovered by two exploratory wells drilled practically simultaneously on the same unproved structure, and other exploratory tests find new producing horizons or extend established fields. In column V are given the excess new reserves added to the backlog of accumulated reserve which presently totals some 19 to 20 billions of barrels. While the discovery rate of oil fields remained above national consumption, as shown by columns VI and VII, until 1941, it is seen by the recent decrease indicated in column V that the margin of safety before which it will be necessary to draw on the oil reserves accumulated in the ground was drawing dan-

TABLE 1
Summary of Recent Well Drilling and Discoveries

YEARS	I Total Wells Drilled	II Total Exploratory Wells Drilled	III Total Successful Exploratory Wells	IV Number of New Oil Fields Discovered	V Net New Reserves Discovered (Million Bbls.)	VI Production of Crude (Million Bbls)	VII Gross Oil Discoveries of Crude Oil (Million Bbls.)
1934	20,793	.....	.....	86	1,668	908	2,576
1935	24,273	.....	.....	104	1,901	966	2,867
1936	28,546	.....	.....	104	1,757	1,099	2,856
1937	33,945	2,224	222	148	1,898	1,279	3,177
1938	28,060	2,638	294	166	1,816	1,214	3,030
1939	27,659	2,589	224	170	766	1,264	2,030
1940	30,656	3,038	302	217	674	1,353	2,027
1941	32,210	3,264	503	209	400	1,404	1,804
1942	21,412	3,045	493	261	—585 (min.) —1,068 (max.)	1,385	800 (max.) 317 (min.)

Source: The Oil Weekly—Yearbook, February 1, 1943: also, March 2, 1942, and February 8, 1943. Also: E. De Golyer—Petroleum Exploration and Development in Wartime, A.I.M.E. meeting—February 18, 1943.

TABLE 2

Summary of Wildcat Drilling Statistics According to Basis for Location

(After F. W. Lahee, Wildcat drilling in 1937, 1938, 1939, 1940 and 1941, in AAPG Bulletins, for June 1938, 1939, 1940, 1941 and 1942)

YEAR	Geology		Geophysics		Geology and Geophysics		Non-technical or Random	
	Producer	Dry	Producer	Dry	Producer	Dry	Producer	Dry
1937	116	861	82	240	15	66	17	278
1938	192	1,041	78	252	31	69	44	535
1939	135	1,006	69	400	13	40	43	666
1940	198	1,204	100	446	22	81	35	797
1941	300	1,380	143	437	28	111	30	771
Total	941	5,492	472	1,775	109	367	169	3,047
Probable Success	14.6% or 1 of 6.83		21.0% or 1 of 4.77		22.9% or 1 of 4.37		5.2% or 1 of 19	

gerously near and that 1942 shows a definite deficiency of discoveries which may vary between 585 million barrels minimum and 1068 million barrels maximum.

These views become particularly alarming if one considers that exploratory drilling was at a record high during 1942, that a large percentage of successes were scored and that the total volume of oil discovered was smaller than during the preceding eight years. This is accounted for by the fact that the fields discovered were of small size though also indicating the high degree of efficiency which modern prospecting methods have achieved in discovering oil structures of low relief and of small areal extent oftentimes ranging to 10,000 feet deep or more. It decidedly seems that the law of diminishing returns has definitely dawned *again* upon the oil business.

The *again* is purposely used because in the history of oil discovery, cycles of efficiency have definitely been established. The prospecting end of the oil industry is presently made of a combination of techniques which have been used more or less intensely and which have seen their peaks of discovery efficiency followed by relatively low returns.

The first prospecting technique was a purely hit-or-miss proposition, a random location of the exploratory well. To be sure the wildcatter believed in some fallacious theories to guide him in his drilling ventures but he was easy prey to "creekologists," "witchstick operators" and other users of supernatural powers. Oddly enough, the practice of locating wildcat wells without the benefit of scientific research is still a popular method among operators though it is often guided by intuition based on a better understanding of subsurface conditions. Each wildcatter is a geologist in his own merit who has acquired a certain picture of subsurface conditions in his operating territory. He has observed certain elementary rules over a period of years of drilling experience and will often only follow hunches of his subconscious mind to locate a well.

As may be seen from Table 2, the non-technical wildcatter is yet responsible, in spite of scientific prospecting developments, for a good portion of our yearly discovered reserves though his efficiency is low. On this basis, the random wildcatter is, wrongly or rightly, considered an integral part of the industry and when objected to on the ground of his inefficency we are immediately reminded of Dad Joiner's persistent hunches about oil in East Texas which led to the discovery of the biggest of all fields. However, in these days of shortage of tubular steel, equipment and manpower, it seems wasteful of time, energy and material that one should permit such inefficient prospecting methods to go on unchecked, let alone encouraged by officials who are charged with the efficient control and regulation of the industry. From the birth of the oil industry in 1859 until 1910, this procedure was exclusively used in locating oil fields.

At about this latter date, the structural theory of accumulation of oil became almost universally accepted by the industry and companies began to hire geologists whose job it was to locate surface geological anomalies on the theory that they are usually conformable to deep-seated structures containing oil. This proved an unusually successful procedure over the purely hit-and-miss method of former days and by 1920 the method of surface geology coupled with whatever subsurface studies were available had reached a peak. Most surface structures had been found, mapped and leased but many were not drilled until several years later. Subsurface geological prospecting which consists of a detailed study of core and well cuttings from the lithological and paleontological point of view permitted the discovery of further oil-bearing structures, particularly through active core drilling. The geological methods of prospecting found their maximum effectiveness during the years 1920-1930, toward the end of which period they were gradually supplanted by geophysical methods of prospecting of high resolving power, particularly the reflection seismograph and the gravimeter. In the early thirties a surge of discoveries was witnessed which is well illustrated in Table 1 and the effectiveness of the new methods of deep structural prospecting is well shown in a comparative manner in Table 2.

The history and effectiveness of oil prospecting has also been well presented by Wallace E. Pratt from whose data Figure 1 was derived. The figures of Pratt are obtained on a somewhat different basis than those presented heretofore. He considers only major oil fields and such a major field is defined as that which has a reserve of 20,000,000 barrels or more. It is stated that such fields account for 80 percent of the nation's reserves, therefore, the data of Figure 1 are sufficiently representative of the effectiveness of prospecting. In order to smooth out the results and eliminate as much as possible short-term variations, the sums of major reserves discovered during three successive years are added and the sum obtained is plotted at the corresponding last year of the series. The sharp decline observed during the period 1922-25 is an expression of the law of diminishing returns as it applies to surface geological prospecting. This downward curve of oil reserves discoveries occasioned profound concern among the oil executives who looked abroad to expand their operations, particularly in Mexico and South America but also on the Asiatic, European and African continents. Governments, particularly those of the allied countries of the first World War who, according to Lord Curzon, had "floated to victory on a wave of oil" became much concerned over their oil supply lest their converted oil-burning ships become immobilized. It became fashionable for a government to acquire an oil policy which at times led to some sharp diplomatic notes such as after the San Remo Agreement of 1920.

Fortunately, it did not become necessary for the United States to press a foreign oil policy, as by 1924 the application of subsurface geology coupled with the spectacular successes of the torsion balance and refraction seismograph at discovering salt domes on the Gulf Coast yielded reserves which literally flooded the oil market as may be seen on Figure 1 by the sharp rise in oil discoveries from 1925 to 1933. The curve is somewhat distorted by the discovery in 1930, by random drilling, of the East Texas field which contributed some four billion barrels. This correction has been made and the dotted line is probably more representative of the success of the normal prospecting effort during the period 1930-32. In 1933, oil-prospecting effectiveness was again at a low ebb though reserves in the ground were plentiful thanks to state control of

production through proration. Yet, great concern was expressed about the problem of reserves since the discovery methods then in use had attained a point of practically vanishing returns.

Again the situation was saved by the introduction of the reflection seismograph and an improved technique, the gravimeter, which practically supplanted the torsion balance although the latter is an instrument of high geologic resolution compared to the former. Again, discoveries soared as shown both on Table 1 and Figure 1, to reach a peak during the period 1936-38.

Presently, we witness another period of lean returns and great hopes are founded on the introduction of new geological theories concerning the stratigraphic accumulation of oil and of new prospecting techniques under the names of deep electrical resistivity and geochemistry. Refinements in older techniques are also applied, particularly in the interpretation of seismic records for formation pinch-out studies and of gravimetric maps by the study of higher order derivative of the gravitational potential in view of resolving structures buried at great depths. In the stratigraphic approach to oil prospecting a number of new tools as well as refined older techniques are brought into use. Detailed well studies are not only made for the purpose of discovering structural features but mainly for a study of sedimentation trends, location of old shore lines, sand bars, buried channels, formation truncation by unconformity, movement of ground water cementing solutions, etc. In these studies the geologist is greatly helped by new tools such as electrical and radioactive well logging.

The unfortunate part of the present situation is that we are in the midst of a transition period where the rate of discovery by the older methods is low, a situation which is coupled with an accelerated demand above normal by the war effort in the form of aviation gasoline, synthetic rubber, lubricants, fuel oils and explosives derived in whole or in part from crude oil. Implementing the new prospecting campaign is, therefore, handicapped by the pressure of events, the shortage of manpower and material. In view of the difficulties and the necessity of keeping the discoveries of new reserves of oil at least at the level of the accelerated demand as an insurance against the possibility of unfavorable development in the war, the opinion has been expressed that the oil-prospecting effort of the nation should be coordinated and centralized into the hands of those governmental agencies which have set upon themselves to direct the destinies of the oil business.

Productivity Rate

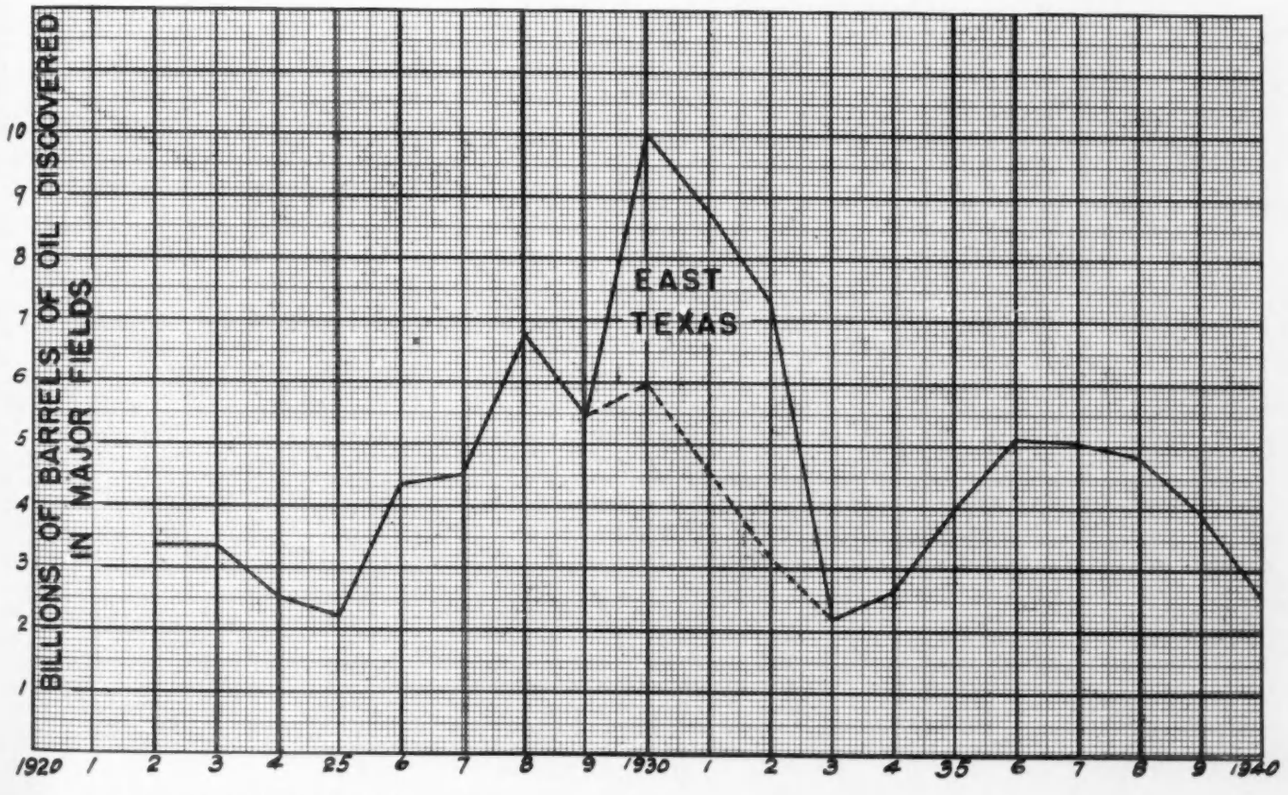
An aspect of the petroleum reserve problem which is often misunderstood is that we not only need to maintain sufficient *visible reserves,* but we must maintain those reserves at a sufficiently *high productivity rate.* The backlog of visible reserves is estimated at about 20 billions of barrels which at the present rate of annual consumption of about 1.4 billions would appear to give us a sufficient margin of safety even when taking the most pessimistic views on the duration of the war. Unfortunately, most of this oil may not be recoverable when nor where needed as the flush production of a well is often rapidly exhausted. Furthermore, the estimate of visible reserves is based on the assumption that the best reservoir engineering practices will be employed in recovering these reserves, which means that considerable time must be allowed for the utilization of reservoir energy to its maximum efficiency. If oil should, for some military reason, have to be withdrawn from the majority of our present flush fields at rates greatly above the optimum rate, it is quite possible that we should subtract from our visible reserves a fraction which may be as high as 15 to 20 percent.

Therefore, the reserve problem is not only one of *adequate visible reserves* but also one of *adequate rate of productivity.* Various solutions may be offered to solve this problem.

Possible Solutions

In the inverse order of importance

FIGURE 1
Experience in Exploration for Oil (After Pratt's "Oil in the Earth," Page 71)



and feasibility, the possible solutions are as follows:

1. Production of synthetic oil from coal and other carbonaceous raw materials.
2. Distillation of oil from shales.
3. Increased application of secondary methods of oil recovery.
4. A scientifically coordinated and planned wildcatting campaign.

1. *Synthetic oil.* There is no doubt that the synthetic production of oil by hydrogenation of coal, lignite, residue oils, asphalts and other carbonaceous materials is a feasible engineering process as it is carried out both in Germany and England on a large scale. Other synthetic processes such as the Fischer-Tropsch and Fischer-Pilcher-Mittelbruck processes use various gases as raw material, mostly hydrogen and carbon monoxide. Low temperature carbonization of coals and lignites can also produce some quantities of oil substitutes. Grain and potato alcohols as well as portable gas generators (gasogene) can contribute a considerable amount of gasoline-equivalent fuel.

Synthetic motor fuels may be produced at a cost three to five times the present cost of natural fuels and in order to produce at the recovery flush rate of 1,000,000,000 barrels a year would require the erection of 1000 million-barrel plants at the cost of possibly 25 billion dollars and requiring a manpower allocation of 4 million workers. Furthermore, the process, on a large scale, would require an increase in coal production of about one half billion tons a year. The above figures are based on the British experience at the Billingham hydrogenation plant.

Obviously the erection of a synthetic fuel industry is a problem of far greater magnitude and cost than the creation of a synthetic rubber industry, and it appears impossible to cope with it on a large scale when the exigencies of war have to be met first.

It would, however, be advisable to have at hand some developed processes of synthetic fuels in the pilot-plant stage so that the nation may not experience another critical period of uncertainty and delays for lack of leadership as was experienced when the rubber situation became critical, should it ever become necessary to consider seriously a synthetic-oil industry. In this respect it is reassuring to note that the United States Bureau of Mines has embarked on a study of various synthetic fuel processes at its Pittsburgh station.

2. *Oil from shales.* The problem of deriving the flush production of oil from oil shales is very similar to the problem of synthetic oil as it would necessitate a comparable outlay of capital, material and time which is not compatible with the exigencies of war.

Here again, the Bureau of Mines has pioneered in a study of the problem long ago and the report of Gavin[3] on the subject makes it appear as a feasible industrial problem, if the consumer is willing to pay for the increased costs of production which are again estimated at three to five times the present price of natural fuels.

In this class of future oil supplies must be included the possibility of developing the Canadian tar sands of the Athabaska region. The Canadian Geological Survey estimates the presence of a reserve of at least 100 billion barrels of oil recoverable from this region by a process quite different from oil-shale distillation. Presently, the outcrops of the Athabaska tar sands are worked at competitive prices with natural petroleum because of the low mining costs of the outcropping sand but it is not estimated that more than a billion barrels are recoverable at the present price for crude.

3. *Secondary Recovery.* It is a well known fact that primary recovery of flush fields as practiced in the early days of the industry and even as late as 1930 was a very inefficient procedure which left in the ground an estimated quantity of oil varying from 50 to 85 percent of the oil originally in place. Present-day practices of primary production are in general more efficient thanks to production control in the main producing states and the application of the best known reservoir-engineering practices. We must, therefore, look upon secondary-recovery practices as "salvaging operations" which as such have a limited scope of application to those fields when the residual saturation warrants sufficient financial returns. It is doubtful that any of the fields brought in during the past 10 years and in which proration and reservoir engineering have been used to best advantage will prove a fertile ground for the application of secondary recovery.

There are further important engineering limitations to the application of secondary methods of production, as follows:

a. *Character of the sand.* Water-flooding is particularly sensitive to variations in permeability, sands of low permeability being particularly adaptable to this method of production, though an upper limit of permeability can not be given beyond which artificial water drive is not to be recommended. The hydrostatic conditions in the reservoir sand have also a bearing on water-flooding operations as there would be little use injecting a driving water flood if the water front will not advance where desired.

Repressuring and gas drive, to the contrary, are most efficient in open sands of high permeability but the recovery is much lower than for water flooding. The degree of the recovery efficiency is measured by the difference in residual-oil-sand saturation before and after application of the method. In the case of water flooding one may normally expect a final saturation of about 20 percent whereas not less than 40 percent can normally be expected with repressuring and gas drive.

b. *Depth Limitation.* In marine operations, if a ship is sunk too deep it is not salvageable; a similar rule holds for salvaging oil fields. The depth limit is particularly sensitive in water flooding, which requires a drilling pattern of closely spaced wells, entailing great expenses in time and material. It is estimated that under present price conditions, water flooding is not economical below 3000 feet. To the contrary, gas drive and repressuring, which often can make use of reconditioned old wells more widely spaced, are not affected adversely by the depth factor.

c. *Productivity rate.* In solving the problem of oil supply we have seen that a high productivity rate is an essential element. The main objection to the extensive use of secondary-recovery methods to solve the problem of oil reserves resides in their low over-all productivity as well as in the low over-all availability. Water flooding is the method which has achieved the greatest productivity per well but, at their peak, the individual wells seldom reach 100 barrels a day. Taking the most conspicuous case as an example, that of the Bradford field, where water flooding has brought productivity to a level nearly equal to that of flush production, or about 17,000,000 barrels a year, this constitutes less than 1.5 percent of the required production of the United States. The spectacular success of Bradford must not mislead us to believe that water flooding will be able to bring back the productivity of a field to its previous flush rate. The Bradford field is operated under ideal conditions of permeability which gave the field a low flush rate and a high water-flooding rate. For other fields of higher sand permeability the flush rate will prove considerably higher than the possible water-flooding rate.

In repressuring and artificial gas drive the possible productivity rates will prove even more disadvantageous than in water flooding.

Therefore, although secondary-recovery methods may increase our visible reserves by three to five billion barrels through the rejuvenation of the shallow fields, this oil will only be available at a rate too small to relieve the pending *productivity* shortage.

4. *Wildcatting Campaign.* In the past, the crude oil necessary to supply the

rapidly expanding demand by the automobile users and by oil-burning furnaces and appliances was successfully furnished by the discovery of new pools. Often discoveries ran so far ahead of demand that proration was instituted in order to distribute the production equitably among all producers. As we have seen above, the demand was successfully met by devising new theories and techniques for finding the oil and they were used intensively until the law of diminishing returns made it unprofitable or until all fields discoverable by these theories and methods had been found. Presently we are approaching another period where the returns of our present prospecting techniques are vanishing, not so much by their number as by their overall reserves. The amount of oil discovered so far in the United States totals about 46 billion barrels and the question naturally arises as to the possible exhaustion of discoverable oil in large quantities. The protagonists of the solution of the reserve problem by a scientifically planned campaign base their assertions on the assumption that large quantities of oil are still discoverable and that most of this oil is probably contained in what is known as the *stratigraphic-type trap*, the structural traps of major importance having presumably been discovered and tested, at least in the known petroliferous provinces.

If we knew more about the origin of oil, the mode of its formation, the amount and kind of mother substance needed, and the migration and accumulation of oil, we could make a safe estimate of the amount of oil yet present in the producing sedimentary basins as well as in the possible petroliferous provinces. In the present state of our knowledge such an estimate must be considered as a mere guess and few geologists have ventured to make public statements on the subject. The only one made seems to be that of Dorsey Hager[4] who estimated the discoverable oil on a volumetric basis as a certain percentage of the volume of sedimentary rocks; he places the discoverable oil just short of 50 billion barrels. If such be the case the oil men can hope that we do not need to look for synthetic nor shale oil at this time in order to attain a sufficient high productivity rate to meet the demands which may be placed upon them by the war emergencies.

That the bulk of the undiscovered oil will be found in stratigraphic traps also appears quite certain because the major structural traps have been found and tested, leaving only second- and third-rate structural prospects as is well attested by the numerous relatively insignificant pools which are now brought into production.

Stratigraphic Traps

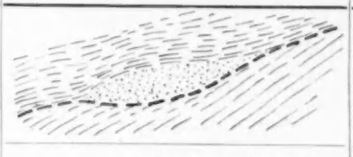
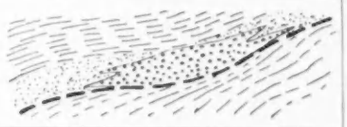
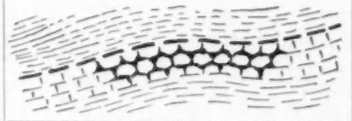
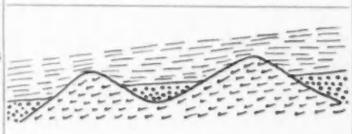
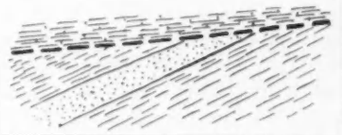
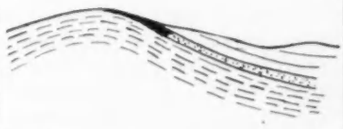
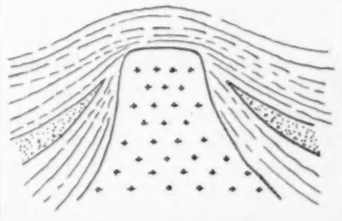
Stratigraphic traps are not completely devoid of structural relations as an effective reservoir for oil must necessarily be associated with a migratory promoting force which generally is the tilting of the sediments. Thus, the presence of an uplift in the sediments is a prerequisite to the formation of a successful trap and the search for stratigraphic pools must first be directed toward the recognition, discovery and outline of the subsurface uplifts overlain by source and reservoir rocks. This is the reason why general geologic as well as reconnaissance magnetic and gravimetric surveys should be made available immediately to the wildcatters.

A stratigraphic pool may be defined as a reservoir closed through lack of adequate lateral permeability. Three classes (Table 3) of stratigraphic pools may be distinguished according to their genesis:

1. *Lenses.* A geologic lens is defined as a body or rock whose thickness reduces to zero in all lateral directions.

Suitable lenses in the form of oil

TABLE 3
Classification of Stratigraphic Traps
Adapted from W. B. Wilson[5] and K. C. Heald[6]

	Specific Type of Reservoir Closure	Schematic Cross-Sectional Representation	Type Pools or Locality
(1) Lensing	Lensing sand or sandstone in shale body (off-shore bars, shoestrings, etc.)		Bradford, Pa. Shoestring sand pools, Kansas
	Lensing sand or sandstone in sand body (permeability wedges)		Glenn, Okla. Burbank, Okla. Clinton Pools, Ohio Hugoton, Kansas
	Lensing permeable zone in limestone or dolomitic bodies (solution pockets)		Yates, Texas Lima-Indiana fields West Texas fields
	Lensing permeable zones in igneous body (weathering pockets)		Lytton Springs, Texas
	Lensing basal conglomerates or gravels in weathering pockets along buried hills		Granite Wash fields, Texas Buried Granite Ridge fields, Kansas and Oklahoma "Chat" fields, Kansas
(2) Truncation	(a) with overlap seal (wedging-out)		Wilcox and Simpson sand zones, Oklahoma City Woodbine sand, East Texas
	(b) with surface or subsurface organic seal		Coalinga, Calif. (surface) Arbuckle zone, Oklahoma City
(3) Pinch-out	Mechanical seal by pinching or squeezing		Piercement type salt domes

traps may be formed through various geologic processes:

a. Formation of sand lenses in the depressions of surfaces of unconformity enclosed by impermeable shales. This is the common type of fields known as off-shore bars. The trends of these lenses are roughly parallel to the paleogeographic shore lines contemporaneous of the unconformity though recurving spits or hooks are not infrequent as a consequence of shore-line water currents. Such hooks are particularly frequent in the Appalachian oil fields. (Vestiges of similar sand bars may be found along present shore lines in Lake Erie and along the coast of Massachusetts at Sandy Hook.)

b. Formation of porosity wedges through cementation by circulating water. Proximity to the surface of the earth or faulting must be postulated in order that cementing solutions may actively circulate.

c. Formation of permeable lenses in calcareous rocks, yielding solution pockets. The limestone or dolomitic formations must again be in sufficiently close relation to an unconformity or a fault in order that the necessary water circulation may obtain.

d. Formation of a permeable zone in igneous rocks. Similar conditions of solution as under (c) are again required.

2. *Truncation.* A geologic truncation occurs when the extent of a formation is abruptly terminated in one direction without appreciable progressive thickness reduction. In order that a truncated permeable rock may serve as a reservoir it must be sealed by some impermeable cap rock, usually transgressing shales. The truncation of the reservoir is achieved by erosion and, therefore, emergence or uplift is again a requisite for this type of trap. When the accumulation is contemporaneous with the uplift there is danger that the oil might escape before it is successfully trapped. The contact of air and oil may, however, produce a bituminous seal which subsequently may be buried.

3. *Pinch out.* A formation pinch out may be produced by mechanical squeezing as appears to be the case in piercement-type salt domes though it is hard to visualize a relatively incompressible rock, such as sandstone, being squeezed to zero thickness by mechanical pressure. It is more probable that the squeeze in a salt dome is accompanied by mechanical flow. Another likely possibility is that the salt dome producing a mechanical squeeze was being uplifted at the same time as the formations were deposited around it, thus partly explaining the thinning of the beds on the periphery of the salt.

Stratigraphic Search

Admittedly the geological and geophysical search for stratigraphic traps is a much more difficult and complex procedure than the relatively simple techniques employed in locating closed geological structures. Valuable suggestions for finding stratigraphic pools have been made by Monnett[9] and Kornfeld[10].

The geological search would consist in the following steps:

a. Location of the surface and subsurface structural uplifts. Surface uplifts are usually well known at present but the detailed geology of many could be coordinated, simplified and generalized. The subsurface uplifts can be detailed by surface as well as subsurface geological work where wells are available, but also by geophysical work done on a large scale, specially magnetrometric and gravimetric surveys.

b. Construction of detailed paleogeographical maps showing with as much precision as possible the ancient shore lines at various geological periods contemporaneous to the deposition of the expected main producing horizons. This will help in locating unconformities and the possible presence of truncated, pinched-out or wedged-out reservoir beds.

c. Construction of isopachous maps of geologic intervals as thin as possible; this will help to locate possible off-shore bars, shoestring sands, recurving spits and hooks, etc., since sands are relatively incompressible whereas shales are very compressible. Admittedly, sufficient information is seldom available for the construction of such maps in great enough details in order to pin down a possible stratigraphic trap, and numerous gaps will have to be filled before a sound test well may be recommended.

The above geological ground clearing should be supplemented by some of the following steps:

1. Drilling of a number of geological wells for the main purpose of securing lacking information on lithological and porosity or permeability variations, thinning, presence and depth of unconformities, water composition, etc. These wells should preferably be drilled by portable core-drilling machines by the procedure now known as slim-hole drilling and located in lines normal to the direction indicated by the paleogeographical shore lines. Normally, these geological tests need not be prohibitively deep but occasionally a test could be drilled to deeper horizons so located as to test both the deeper geological conditions as well as the presence of oil in commercial quantities. In this core-drilling program, electrical and radioactive logging and perhaps geochemical logging should play an important part.

2. Drilling for geological information is naturally expensive as well as time-, manpower - and equipment - consuming and it is indicated that some short-cut geophysical methods should be attempted so as to reduce the drilling program to a minimum. Presently recognized geophysical methods of prospecting are not very well suited to the discovery of stratigraphic traps though there is a possibility of adapting the reflection seismograph to this problem. It has already been suggested that it could be used to determine rock porosity by the measurement of the interval of time between a reflection from the top and bottom of a sandstone formation. This would require a much greater precision than now possible in picking out the onset of a reflected wave. Reinterpretation of old seismic records as well as new shooting may also reveal stratigraphic traps if the interpreter will carry all possible reflections and give them an interpretation in terms of pinch-out and truncation rather than the usual structure interpretation. In association with all other available geological information this is not an impossible task.

Certain new methods of prospecting have great potentialities in the search for stratigraphic traps. Among these can be cited the polarization method of Potapenko[7] and the conductivity method of Evjen[8]. Other improvements in electrical prospecting purport to obtain electrical logs from the surface without the help of a bore hole. No doubt, such an advance would be of major importance in stratigraphic prospecting. Above all, the geochemical methods of prospecting recently proposed have already scored a certain number of outstanding successes but the skepticism of the oil fraternity is yet for the most part unbroken. Since no oil-discovery method is yet infallible, the proof of a new discovery tool is forcibly of a statistical nature and a rather large number of failures and successes must be accumulated before the resolving power of an oil-discovery method is known even approximately. Even in the case of prospecting methods of long standing and highly considered among professional men, such as the reflection seismograph, the resolving power is not well known because some failures have been attributed to the method when a proper understanding of the precision of the measurements made did not warrant the drilling of a well, whereas, in other cases, discoveries have been wrongly credited to the seismograph. An outstanding example of this last instance is the Zenith pool, Kansas, which was a stratigraphic trap unexpectedly drilled into when testing a seismograph structure.

A remark worth re-emphasizing is that no method of discovery is perfect in itself and, therefore, as many dis-

[*Continued on page 76*]

Wildcat Drilling and Discovery Rates in 1942

By FREDERIC H. LAHEE, Chief Geologist, Sun Oil Company

THE total number of wildcats drilled in 1942, in the states, covered by this report, was 3219, and the footage drilled was 12,172,851, as contrasted with 3264 holes and 11,615,085 feet, respectively, in 1941. The average depth of hole increased from 3559 feet to 3782 feet for all states covered, and from 4372 feet to 4659 feet in the southern states.

This resume on wildcatting is followed by a study of discovery rate in the eleven states of Arkansas, California, Illinois, Indiana, Kansas, Louisiana, Michigan, Mississippi, New Mexico, Oklahoma, and Texas. Discovery rate is measured by the relations between wildcatting and the discovery of new reserves during the last six years. Except for a slight rise, in 1941, in the curves expressing rate of discovery, there has been a decline since 1937. Last year, in our annual resume, we stated that these facts are a challenge to the industry not only to expand exploration, but also to promote research which may in any manner improve or revise our present methods of looking for oil. This same challenge remains today, and the urgency for improvement in the situation is greater than ever. Many more wildcats must be drilled, but to do this we should have sufficient materials and manpower, sufficient practical incentive, and protection from burdens too severe, both financial and legal.

The writer acknowledges with thanks the kind assistance and cooperation of the following gentlemen in compiling data for this summary: A. P. Allison, A. H. Bell, A. S. Berger, K. E. Born, N. Burnett, D. H. Cardwell, George V. Cohee, R. J. Cullen, M. H. Funk, G. C. Gester, M. D. Hubley, E. A. Koester, C. S. Lavington, G. D. Lindberg, A. M. Lloyd, Graham B. Moody, D. J. Munroe, Jack Parker, C. H. Row, G. C. Sleight, L. C. Smith, and E. B. Wilson.

This paper is to be presented at the annual meeting of the American Association of Petroleum Geologists, in Fort Worth on April 7-9, and will be published in the June, 1943, issue of the A. A. P. G. Bulletin.

THIS paper reviews data on wildcat drilling for the eighth consecutive year.[1] The states which information was available are indicated in Figure 1.

We have continued to use the definition of a wildcat as a hole drilled completely outside the known boundaries of pools already developed, and far enough from producing areas to be essentially a test of new possibilities. Generally speaking, such a hole would be at least 2 or 3 miles from production; but, where subsurface conditions may change within short distances, as in the case of lensing sands and salt-dome structures, and where, consequently, predictions based on the known may turn out to be greatly in error, a test hole may be regarded as a wildcat even if it is only ½ or ¾ mile from production or from an abandoned dry hole. It is important to note that this does not make *distance* from a pool the sole factor in the definition. Often a hole to be drilled within less than a mile from production is just as much a wildcat, is just as much a financial risk, and should receive just as much encouragement in the search for new reserves, as a hole 2 or 3 miles from production. In every case the degree of uncertainty of the geological conditions should be taken into consideration.

In compiling the data, questions have arisen as to just how to classify footage drilled in certain wells which are strictly neither dry holes nor producers from top to bottom. For instance, within the boundaries of a pool a hole may be drilled below the lowest pay zone in search of some unknown new pay. In the sense that it is exploring for deeper untested possibilities, its footage drilled below the lowest known pay is wildcat. It might be called a semi-wildcat. If it discovered oil or gas in a deeper formation this extra footage might be listed as semi-wildcat-discovery footage; and if, on the other hand, it failed to find a deeper pay, the depth drilled below the lowest producing formation would then be termed semi-wildcat dry footage. Semi-wildcat footage of this kind amounts to only a very small percentage of the total-wildcat footage, and a hole deepened for the purpose of seeking new unknown pays below the deepest known producing horizon is hardly to be regarded or listed as a wildcat hole, provided it was drilled originally with the object of producing from the known horizon. However, a hole which is drilled within the limits of a pool, but with the express object, from the start, of passing up the known pays and going on down to look for new prospects is, we believe, properly listed as a wildcat and is credited with its entire footage from the surface of the ground.

A somewhat similar case is that of a wildcat well drilled through one or more prospective pay zones to a considerably greater depth and then plugged back to completion as a producer. In a hole of this kind, since the total depth would be charged against the cost of the completed producer, we have listed this well and its *total* depth in the column for producers.

A question was raised last year as to whether actual footage drilled within the calendar year should be the basis of "footage drilled" or whether, as in past reports, the total footage of all the holes actually completed or abandoned within the calendar year should be used. We have continued the latter course, first, in order that this year's figures may be more properly comparable with the figures in the earlier reports; second, because the former method requires more detailed analysis on the part of those furnishing the statistics; and third, because we are as much concerned wtih individual holes, as with footage in these holes, and the former method would involve considerable repetition in the *number* of holes wherever the holes were started in one year and finished in a succeeding year.

On the maps (Figures 1, 2, and 3), numbers in parentheses indicate total footage drilled; figures preceding paren-

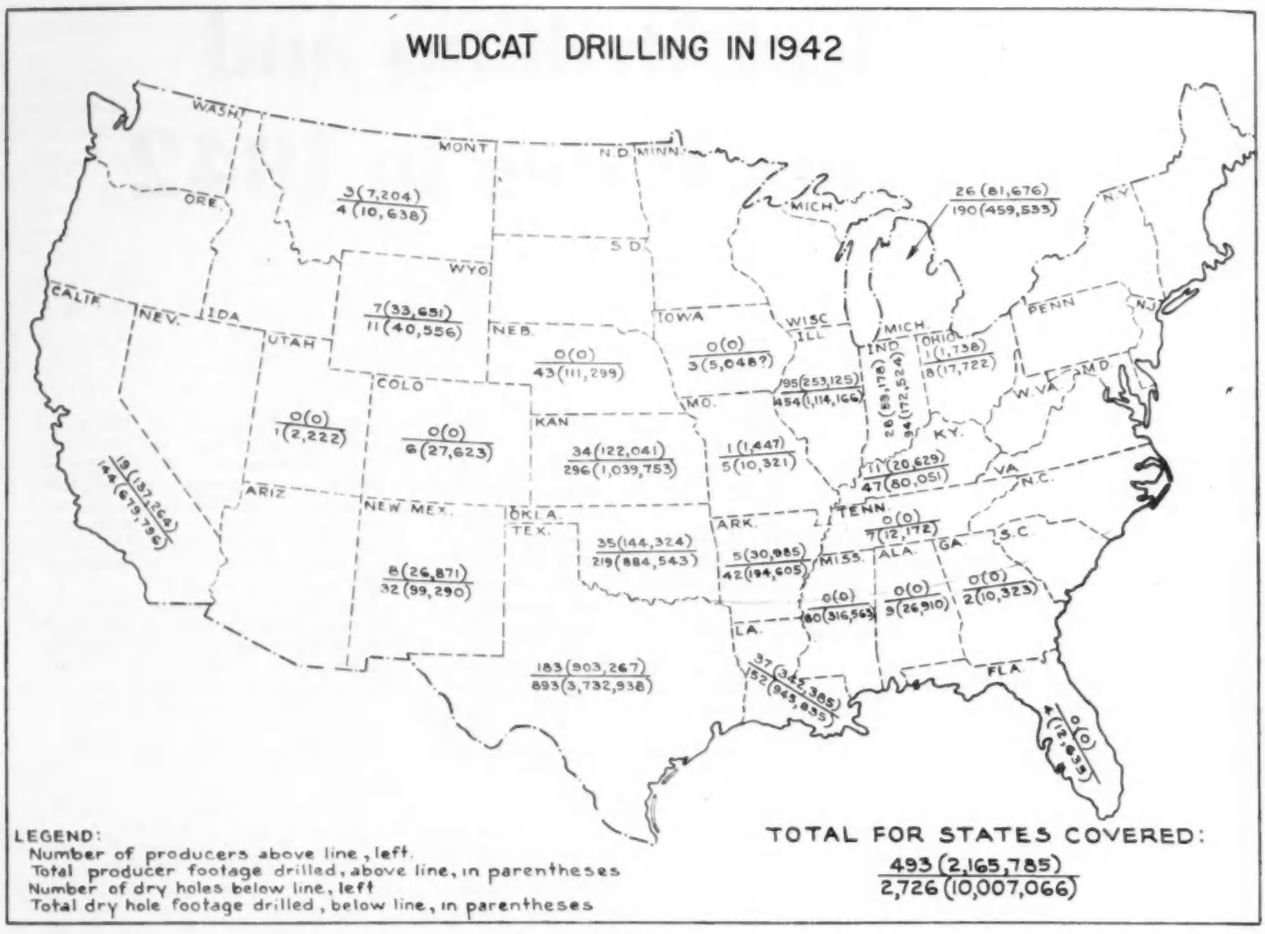


FIGURE 1

theses indicate the number of holes drilled; figures above the cross line are for producing wells, that is, oil, oil and gas, distillate and gas, and gas; and figures below the cross line are for dry holes.

In the states covered in this review, as shown in Figure 1, and listed in Table 1, during 1942 a total of 12,172,-851 feet was drilled in 3219 holes, divided as follows:

493 producers..... 2,165,785 feet
2726 dry holes .....10,007,066 feet

This means that 15.3 percent of the holes drilled, and 17.8 percent of the footage drilled, was successful in 1942. One producer foot was drilled for every 4.62 feet of dry hole. One discovery well was drilled for every 5.14 dry holes. The average depth of hole was 3782 feet.

In the Southern states district (Figure 2), in 1942, a total of 6,633,893 feet was drilled in 1424 holes, divided as follows:

232 producers .....1,296,558 feet
1192 dry holes .....5,337,335 feet

In this area, then, 16.3 percent of the holes drilled, and 24.5 percent of the footage drilled, was successful. One producer foot was drilled for every 4.12 feet of dry hole. One discovery well was drilled for every 5 dry holes. The average depth of hole was 4659 feet. For comparison with statistics for this same area in 1938, 1939, 1940, and 1941, see Table 2.

Selection of the location for a wildcat well may be based on geology (surface geology, subsurface geology, trend along known structural or stratigraphic conditions, local or regional, or shallow exploratory drilling); or it may be based on geophysics (exploration by seismograph, torsion balance, gravity meter, magnetometer, *et cetera);* or it may be

TABLE 1
Number of Oil Wells, Gas Wells, and Dry Holes Drilled as Wildcats in 1942

STATES	OIL DISCOVERY		GAS DISCOVERY*		DRY		Total Number of Holes	Total Footage Drilled	Average Depth of Hole in Feet†
	Number of Holes	Footage Drilled	Number of Holes	Footage Drilled	Number of Holes	Footage Drilled			
Alabama	....	.....	....	.....	9	26,910	9	26,910	....
Arkansas	3	20,454	2	10,531	42	194,605	47	225,590	4800
California	18	132,010	1	5,254	144	679,796	163	817,060	5013
Colorado	....	.....	....	.....	6	27,623	6	27,623	....
Flordia	....	.....	....	.....	4	12,635	4	12,635	....
Georgia	....	.....	....	.....	2	10,323	2	10,323	....
Illinois	89	249,887	6	3,238	454	1,114,166	549	1,367,291	2490
Indiana	28	59,178	....	.....	94	172,524	122	231,702	1899
Iowa	....	.....	....	.....	3	(?)5,048	3	(?)5,048	....
Kansas	30	107,433	4	14,608	296	1,039,753	330	1,161,794	3521
West Kentucky	10	19,364	1	1,265	47	80,051	58	100,680	1736
Louisiana	23	202,928	14	139,457	152	945,835	189	1,288,220	6816
Michigan	23	75,936	3	5,740	190	459,533	216	541,209	2506
Mississippi	....	.....	....	.....	60	316,563	60	316,563	5276
Missouri	1	1,447	....	.....	5	10,321	6	11,768	....
Montana	2	5,652	1	1,552	4	10,638	7	17,842	....
Nebraska	....	.....	....	.....	43	111,299	43	111,299	2588
New Mexico	7	19,921	1	6,950	32	99,290	40	126,161	3154
Ohio, Northwest	1	1,738	....	.....	8	17,722	9	19,460	....
Oklahoma	32	137,542	3	6,782	219	884,543	254	1,028,867	4051
Tennessee	....	.....	....	.....	7	12,172	7	12,172	....
Texas	140	657,823	43	245,444	893	3,732,938	1,076	4,636,205	4309
Utah	....	.....	....	.....	1	2,222	1	2,222	....
Wyoming	4	20,313	3	13,338	11	4,556	18	74,207	....
Totals	411	1,711,626	82	454,159	2,726	10,007,066	3,219	12,172,851	3782

* Gas-distillate wells, of which there were 29, are included in this column.
† Averages have been recorded here only for states where more than 25 wildcats were drilled in 1942.

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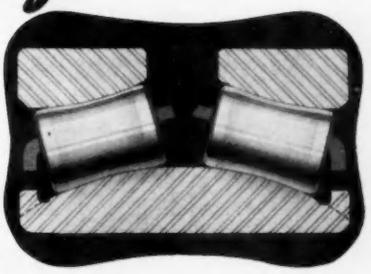

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based on some non-technical suggestion or requirement, such as "creekology," "hunch," "doodlebug," promotion, lease obligation, reported showing of oil or gas in holes previously drilled, *et cetera*. In many cases the reason for choosing the location can not be ascertained.

The reader will observe that this year, in Figure 2, we are dividing Texas into the several Railroad Commission districts instead of the larger scout districts previously used. This may have several advantages. In order to facilitate comparison with 1941 figures, we are introducing Figure 3 in which the Texas statistics for 1941 are likewise shown by the Railroad Commission districts.

In Table 3 are listed the reasons for drilling the wildcats in 1942 using the best information available from men familiar with such statistics, each in his own state or district. According to these figures, 460 wildcats drilled on technical advice (geology and (or) geophysics) were successful (oil or gas), and 2058 were dry; 22 holes, located for non-technical reasons were producers, and 587 were dry; 12 producers and 80 dry holes were located for reasons unknown. These figures show that 18.3 percent of the holes drilled on technical advice were producers as contrasted with 4.9 percent successful in the case of the holes located without technical advice. Therefore, in 1942 locations based on technical recommendations were more

FIGURE 2

TABLE 2
Comparative Statistics for All States Shown in Figure 2*

	PRODUCERS DRILLED				DRY HOLES DRILLED				Total Number Wildcats Drilled	Average Depth of Hole (Feet)	Number of Dry-Hole Feet Drilled for Each Producer Foot
	Holes		Footage		Holes		Footage				
	Number	Percent	Feet	Percent	Number	Percent	Feet	Percent			
1938....	200	13.6	984,262	17.4	1,271	86.4	4,667,402	82.6	1,471	3,842	4.74
1939....	161	12.6	779,345	14.8	1,113	87.4	4,501,669	85.2	1,274	4,135	5.90
1940....	187	12.8	919,506	†14.9	1,279	87.2	†5,251,273	†85.1	1,466	†4,209	†5.71
1941....	258	16.5	1,264,774	18.4	1,305	83.5	5,578,975	81.6	1,563	4,372	4.41
1942....	232	16.3	1,296,558	24.5	1,192	83.7	5,337,335	75.5	1,424	4,659	4.12

* In this table New Mexico data are from southeastern part of the state only.
† See Bull. Amer. Assoc. Petrol. Geol., Vol. 25, p. 1938, where corrections are mentioned for these figures as they appeared in Table II, p. 1001, of the same volume.

FIGURE 3

AND PROVING ADDITIONAL CRUDE OIL RESERVES AT LOW OPERATING COSTS . . .

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TABLE 3
Basis for Locating Wildcats Drilled in 1942

STATE	Geology		Geophysics*		Geology and Geophysics		Sundry Non-Technical		Unknown		Totals		Grand Total
	Prod.	Dry	Prod.	Dry	Prod.	Dry	Prod.	Dry	Prod.	Dry	Prod.	Dry	
Alabama	....	3	....	3	....	....	....	3	....	....	....	9	9
Arkansas	1	13	4	15	....	4	....	8	....	2	5	42	47
California	14	94	2	11	3	16	....	21	....	2	19	144	163
Colorado	....	3	....	2	....	....	....	1	....	....	....	6	6
Florida	....	....	....	....	....	....	....	4	....	....	....	4	4
Georgia	....	....	....	1	....	....	....	1	....	....	....	2	2
Illinois	67	293	5	25	5	13	7	83	11	40	95	454	549
Indiana	23	37	5	13	....	....	....	26	....	18	28	94	122
Iowa	....	2	....	....	....	....	....	1	....	....	....	3	3
Kansas	23	110	5	56	2	12	4	118	....	....	34	296	330
West Kentucky	11	38	....	....	....	2	....	7	....	....	11	47	58
Louisiana	19	37	18	79	....	9	....	21	....	6	37	152	189
Michigan	27	187	....	2	....	....	....	....	....	....	27	189	216
Mississippi	....	22	....	21	....	....	....	17	....	....	....	60	60
Missouri	1	5	....	....	....	....	....	....	....	....	1	5	6
Montana	2	2	....	....	....	....	1	2	....	....	3	4	7
Nebraska	....	9	....	3	....	2	....	29	....	....	....	43	43
New Mexico	6	28	....	1	2	2	....	1	....	....	8	32	40
Ohio, Northwest	....	4	....	....	....	....	....	3	1	1	1	8	9
Oklahoma	9	71	22	84	1	....	3	64	....	....	35	219	254
Tennessee	....	4	....	....	....	....	....	3	....	....	....	7	7
Texas	101	466	49	173	26	73	7	171	....	10	183	893	1,076
Utah	....	1	....	....	....	....	....	....	....	....	....	1	1
Wyoming	3	4	1	2	3	1	....	3	....	1	7	11	18
Totals	307	1,433	111	491	42	134	22	587	12	80	494	2,725	3,219

* Including geochemistry.

than 3.7 times as successful as those drilled without such advice. In the Southern states area (Figure 2) 2.8 percent of the wildcats, located without technical advice, were producers, whereas 19.2 percent of the holes located on technical advice were producers.

Wildcat Trends

Comparing last year's figures[2] with figures for 1942, we note the following conspicuous changes:

1. There was an increase in wildcat drilling in California (up from 124 holes in 1941 to 163 holes in 1942, and up from 640,470 feet drilled in wildcats in 1941 to 817,060 feet in 1942); and in Kansas (up from 237 wildcat holes and 828,473 feet drilled in wildcats in 1941 to 330 holes and 1,161,794 feet in 1942). This was a 31 percent increase in holes and a 27.5 percent increase in total footage in California, and a 40 percent increase in both number of holes and total footage in Kansas. In Mississippi 60 wildcats were drilled in 1942 as compared with 52 in 1941, but the footage increased considerably — from 250,933 feet in 1941 to 316,563 feet in 1942. In Oklahoma there was a slight increase in number of wildcats drilled (up from 246 to 254), and the footage increased from 910,969 feet to 1,028,867 feet.

2. On the other hand, there were moderate decreases in Illinois (591 holes, in 1941, down to 549 holes, in 1942, but the footage increased from 1,341,743 in 1941 to 1,367,291 in 1942); in Louisiana (202 holes and 1,343,341 feet drilled, in 1941, down to 189 holes and 1,288,220 feet drilled, in 1942); and Michigan (231 holes drilled in 1941 contrasted with 216 holes in 1942; but the total footage here increased from 515,969 in 1941 to 541,209 in 1942). In Texas there was a larger drop from 1210 holes and 4,969,336 feet, in 1941, to 1076 holes and 4,636,205 feet in 1942. For Texas this was an 11 percent drop in wildcats drilled and a drop of 6.7 percent in wildcat footage drilled in 1942 as contrasted with 1941.

3. Rather striking is the fact that, in 1942, the average depth of hole increased in all these states except California. The largest increases in average depth of hole were in Mississippi and Oklahoma (in each case a 9 percent increase), and in Texas (an increase of 5 percent).

4. The degree of success of wildcatting with technical advice on locating the hole is still several times that where no technical advice is used, but there seems to be quite a little variation from year to year. In 1937 there were three times as many discovery wildcats drilled on technical advice as there were drilled for non-technical reasons; in 1938 this factor had decreased to between 2.2 and 3.2, and in 1939 it had further decreased to between 1.5 and 2.2. In 1940, it jumped to 3.7, and in 1941 it increased further to more than 5. In 1942, it was 3.7.

Those who are especially concerned with the results of seismographic work will be interested to know that, in 1942, 109 wildcats out of 566 located on seismographic data were successful, and an additional 52 wildcats were successful out of 163 located on a combination of seismographic and geologic advice.

Wildcatting is the industry's method of seeking new oil. From the experience of 1941 and 1942 we may say that 1 wildcat is approximately 6.5 is successful—and this takes into consideration not only all oil-discovery wells but also those which discover gas or distillate and gas.

Meaning of Reserve Studies

There is still an amazing degree of ignorance, or a lack of understanding, evidenced by many people who, in one way or another, are led to use statistics on wildcatting and on oil reserves. And it is notorious that the people who most severely criticize the data and estimates published by committees composed of trained, careful, conservative scientists, are those who do not take the time or trouble to read the reports presented in explanation of these data and estimates. For this reason we shall quote verbatim from our report of last year where we attempted to explain the meaning of "proven reserves" and of "discovery rate."

"After a successful wildcat has been completed as a producer, other wells are subsequently drilled and these gradually outline the limits of the pool. Where development is slow, or the pool is large, this process of outlining the pool may require several years. There is always a lag. After the first well has been completed, or perhaps after several wells have been completed, an estimate can be made of the quantity of oil present in the drilled area, and this area is taken as essentially proved. If the pay sand is thick and uniform and fairly even in its permeability, a larger acreage may be regarded as 'proved' by the drilling than in the case where the sand is thin, irregular in permeability, and likely to pinch out. If the form and dimensions of the structure, or 'trap,' are pretty definitely known, an early estimate may be attempted of the quantity of oil present in the whole reservoir, including its undrilled parts. This is an attempt to guess at the ultimate total reserve rather than at the 'proved' part of this ultimate total reserve.

"Both of these methods of estimating reserves[3] are justified. Each has its definite uses, but *the two should not be confused.* Where estimates are made of *proved* reserves, additions and revisions are periodically necessary, and eventually, after a pool has been completely drilled, the original estimate of the proved reserve plus the subsequent additions and revisions may come somewhere near the total ultimate reserve as estimated near the beginning of development of the pool. However, it is evident that such an early estimate, based on scanty data, is likely to be in error, and the percentage error is likely to be much greater than the percentage error in an estimate of *proved* reserves, made at any given time.

"Rate of discovery is the rate at which new oil reserves are discovered, but a graphic picture of this rate may

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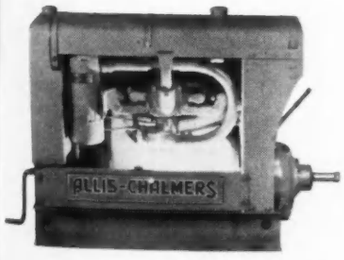

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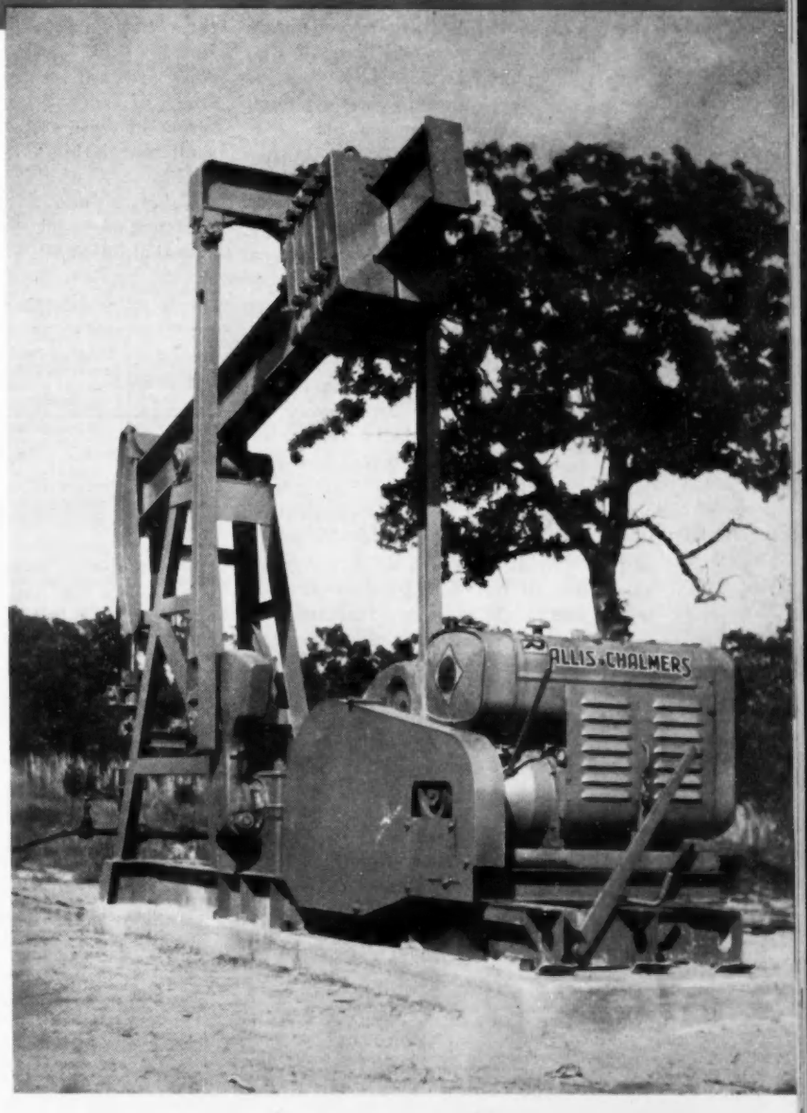

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TABLE 5

Statistics on Wildcats in Area of Eleven States*

	LOCATED ON TECHNICAL BASIS				NON-TECHNICAL LOCATION				UNKNOWN BASIS FOR LOCATION				TOTAL				GRAND TOTALS	TOTAL FOOTAGE		No. of Feet in Dry Holes Drilled Per Foot in Producing Wildcats
	Producers		Dry Holes		Producers		Dry Holes		Producers		Dry Holes		Producers		Dry Holes					
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Wildcats	Producers	Dry Wildcats	
1937	214	16.05	1,119	83.95	17	5.80	276	94.20	48	9.21	473	90.79	279	12.99	1,868	87.01	2,147	1,188,366	7,002,875	5.89
1938	283	17.93	1,295	82.07	43	7.61	522	92.30	17	4.67	347	95.33	343	13.68	2,164	86.32	2,507	1,482,889	7,119,867	4.80
1939	216	13.33	1,404	86.67	43	6.15	656	93.85	10	4.85	196	95.15	269	10.65	2,256	89.35	2,525	1,107,395	7,344,424	6.63
1940	309	15.69	1,660	84.31	35	4.57	731	95.43	11	8.09	125	91.91	355	12.37	2,516	87.63	2,871	1,397,496	8,416,015	6.02
1941	463	20.17	1,832	79.83	29	3.92	710	96.08			55	100.00	492	15.92	2,597	84.08	3,089	2,023,184	9,222,217	4.55
1942	439	18.25	1,967	81.75	21	3.81	530	96.19	11	12.36	78	87.64	470	13.37	2,575	86.63	3,046	2,101,116	9,639,546	4.59
Tot. for '37-'41	1,485	16.88	7,310	83.12	167	5.45	2,895	94.55	86	6.70	1,196	93.30	1,738	13.22	11,401	86.78	13,139	7,199,330	39,105,398	5.43
Tot. for '38-'42	1,710	17.33	8,158	82.67	170	5.12	3,149	94.88	49	5.76	801	94.24	1,929	12.83	12,108	87.17	14,037	8,112,080	41,742,069	5.13

* This area includes Californian, New Mexico, Texas, Oklahoma, Kansas, Arkansas, Louisiana, Mississippi, Illinois, Indiana and Michigan. Full statistics were not available on the other producing states.

vary considerably according to whether we regard as the oil discovered in any given year the quantity of new oil *proved* by drilling in that year, or the quantity of total new oil estimated to fill the reservoir, or reservoirs, discovered in that year. Although in overlapping periods of several years each, the pictures might be somewhat similar, in single-year intervals there may be wide discrepancies between the rate of discovery calculated in the two ways, due to lag in development, size of pool, *et cetera*.

"The suggestion has been offered that a more correct picture of the rate of discovery could be obtained by annually relegating back to the year of discovery the reserves subsequently uncovered each year by drilling; but this would not only involve an enormous amount of work, but also, in the end, as far as we can see it, there would be little gained. For of what particular value would it be for us to know, *merely as a means of gauging discovery rate,* that a reserve of over 4 billion barrels of oil was found in 1930 in the East Texas field? Of more significance—again, only as applied to the study of discovery rate—is the quantity of new oil made available each year as drilling of this field progressed. We repeat that, while there *are* real and important reasons for making early estimates of total ultimate reserves in a pool, we believe that *the soundest method of measuring rate of discovery must be based on new reserves as proved by drilling.*"

Relation of Reserves

Among all the states listed in Table 1, there are 11 in which wildcatting has been especially active during the past few years. These 11 are: Arkansas, California, Illinois, Indiana, Kansas, Louisiana, Michigan, Mississippi, New Mexico, Oklahoma, and Texas. Also within this group of 11 states is 95 percent of the country's proved oil reserves (as of January 1, 1943). It was for these reasons that last year we made a special study of wildcatting in relation to reserves in these states; and this year we shall repeat this survey as it applies to 1942.[4]

Tables 4 and 5 need no particular comments, except that the reader will note that, in Table 5, we have contrasted

TABLE 4

	Estimated Proved Reserves in U. S. at Beginning of Year* (Barrels)	Wildcats Drilled During Year Indicated*	
		Number	Footage
1937	13,063,000,000	2,224	8,387,615
1938	15,507,268,000	2,638	8,860,484
1939	17,348,146,000	2,589	8,624,602
1940	18,483,012,000	3,038	10,144,870
1941	19,024,515,000	3,264	11,615,085
1942	19,589,296,000	3,219	12,172,851
1943	20,082,793,000	.....	.....

* These figures for reserves include the entire United States, but for wildcats they include all states regarded as prospective for oil except New York, Pennsylvania, Eastern Ohio, West Virginia, and Eastern Kentucky.

The above figures on reserves were taken from "Facts and Figures," 7th ed., p. 74, published by the American Petroleum Institute, 1941. Figures for reserves as of January 1, 1942, were taken from the Am. Petrol. Inst. Quarterly for April, 1942. Figures for January 1, 1943 (December 31, 1942) were taken from a recent press release from the American Petroleum Institute. The data for wildcats were taken from the articles printed in the A. A. P. G. Bulletin, and listed in footnote 3.

averages for the five-year period from 1937 to 1941, inclusive, with averages for the overlapping 5-year period of 1938-1942, inclusive.

There are several ways of estimating the degree of success of wildcat drilling. We have called successful those wildcat holes (and the footage drilled in these holes), which were completed as commercial producers. However, we can consider wildcatting in relation to oil reserves discovered by this class of drilling. In Table 6, under A, are recorded the proved reserves as of January 1 in each of the indicated years, and for the 11-states area under discussion. Under B is shown, for each January first, the net change in estimated proved reserves since the preceding January first, allowing for production during that 12-month period. Under C are the new proved reserves which are directly attributable to wildcat discoveries made during the year. Under D are the revisions and additions of estimated proved reserves in fields already discovered in previous years, these revisions and additions having been made on the basis of new information obtained through development during the year indicated. Under E all the new reserves (C + D) are totaled for each year.

Last year an item was included in Table 6[5] showing the "number of years of remaining supply," a figure derived by dividing the total proved reserves as of January 1 of a given year by the total production of the preceding year. This

TABLE 6

Statistics on Proved Reserves in Area of Eleven States*

	1937	1938	1939	1940	1941	1942	1943
A. Proved reserves as of January 1, of year indicated	12,241,885,000	14,664,035,000	16,630,452,000	17,723,393,000	18,226,542,000	18,816,785,000	19,260,415,000
B. Net change in proved reserves since January 1 of previous year	.....	*2,422,150,000	1,966,417,000	*1,092,941,000	*503,149,000	*590,243,000	*443,630,000
C. New proved reserves discovered during year indicated	896,692,000	805,293,000	337,989,000	280,882,000	423,551,000	254,801,000	.....
D. New reserves added through extensions and revisions of old fields during year indicated	2,739,254,000	2,313,356,000	1,955,507,000	1,505,816,000	1,496,610,000	1,496,536,000	.....
E. Total new proved reserves added (C+D)	3,635,946,000	3,118,649,000	2,293,496,000	1,786,698,000	1,920,161,000	1,751,337,000	.....
F. Production during year indicated	1,213,796,000	1,152,231,000	1,200,555,000	1,283,490,000	1,329,918,000	1,307,707,000	.....
G. Newly discovered reserves (C) per wildcat hole drilled in year indicated	417,647	321,217	133,857	97,834	137,115	83,600	.....
H. Newly discovered reserves (C) per foot of wildcat hole drilled in year indicated	109.4	93.6	39.9	28.6	37.7	21.7	.....
I. New proved reserves (E) per wildcat hole drilled in year indicated	1,693,500	1,243,976	908,315	622,326	621,612	574,900	.....
J. New proved reserves (E) per foot of wildcat hole drilled in year indicated	443.88	362.52	271.36	182.07	170.75	149.1	.....

* This area includes Arkansas, California, Illinois, Indiana, Kansas, Louisiana, Michigan, Mississippi, New Mexico, Oklahoma and Texas. All figures are in barrels.

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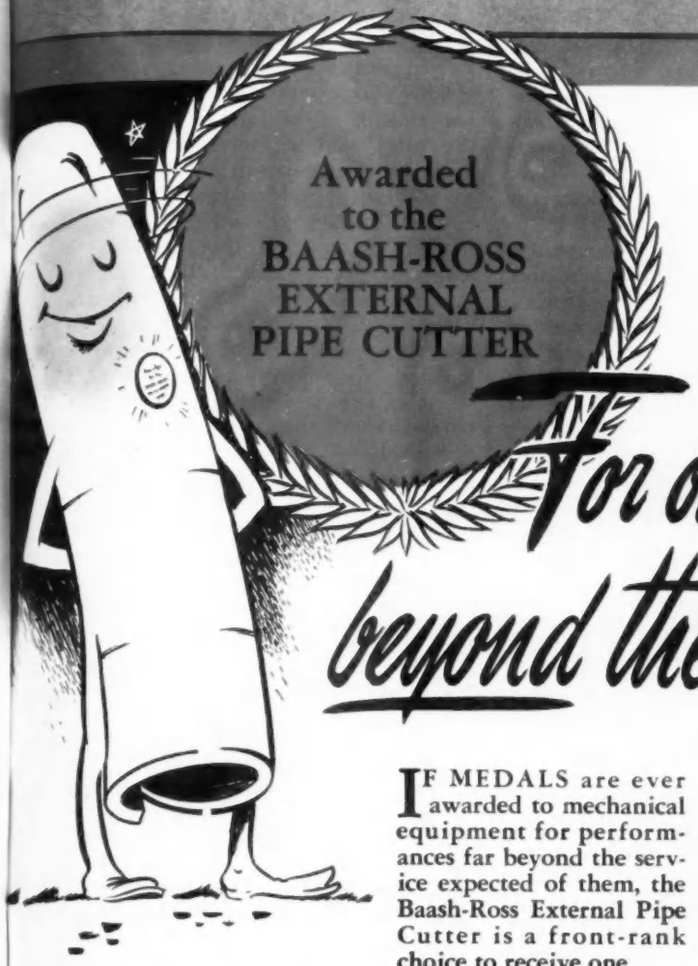
OIL WEEKLY EDITION



The story of another remarkable cutting job performed by a Baash-Ross Pipe Cutter!

For outstanding performance beyond the normal line of duty!

IF MEDALS are ever awarded to mechanical equipment for performances far beyond the service expected of them, the Baash-Ross External Pipe Cutter is a front-rank choice to receive one.

Some time ago this cutter set a world's depth record that has never been even closely approached . . . *6 successive cuts at depths in excess of 12,000 feet—the last at a depth of 14,366 feet—over a* THOUSAND feet *deeper* than the world's deepest producing well and only a few hundred feet short of the all-time record drilling depth!

Recently, this External Pipe Cutter successfully completed *another* tough assignment that illustrates beyond the shadow of a doubt the unusual ruggedness and dependability built into the tool. Although designed for cutting tubing and drill pipe—which in itself is a man-sized job—this Baash-Ross Cutter went down 6,800 feet where it cut—and recovered—over 62 feet of 5¾" DRILL COLLAR!

The drill collar had a bore of 2¼" . . . which means that a solid *1¾ inch* wall of tough, *hardened* alloy steel had to be cut through by the knives of the cutter. *That's over* FIVE TIMES *the thickness of 6⅝" API Drill Pipe* . . . and far beyond the service for which these cutters are intended!

Of course, we don't recommend drill collar cutting as standard practice for the Baash-Ross Cutter. But this cutting record is further proof that, inherent in *all* Baash-Ross Fishing Tools there is an extra margin of "beyond-specification" performance . . . a performance margin that means extra safety and efficiency on *every* fishing and work-over job, regardless of the working depth or operating conditions!

These are times when you need every performance advantage obtainable to assure the success of your fishing and repair work. So why not call in your nearby Baash-Ross representative on ALL your fishing operations and get the protection of tools built to perform *beyond* the limits of normal service?

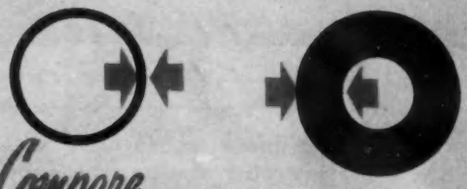
(Baash-Ross Cutters are leased in U.S.A.—Sold for export only)

THE TOOL THAT CUT 1¾" OF SOLID ALLOY STEEL!

The Baash-Ross External Pipe Cutter, in slicing through 5¾" drill collar, cut *five times* the thickness of 6⅝" drill pipe. Not only that, but drill collars are made of special alloy steel that is hardened and toughened by multiple heat-treatments—*a steel that is much harder to cut than API pipe-steel!*

One of the reasons why the Baash-Ross Cutter can successfully make such a heavy cut is the "cushioned" feed of the knives against the metal. Notice the spring above the knives? Cutting pressure to the knives is transmitted through this spring, thus smoothing out all roughness and vibration as the string rotates. This assures a constant, uniform feed throughout the cut-off operation. Contrast this with the rough, chattering action that is apt to occur where pressure is applied directly to the knives without any cushioning spring!

Another important advantage is that no separate overshot is necessary to hold the cut-off section of pipe. This Cutter not only cuts the pipe, but also supports it while it is removed from the hole, saving time, extra operations, and increasing the simplicity and safety of making cuts with this tool!



Compare in the scale drawings above, the wall thickness of the 5¾" Drill Collar with that of 6⅝" Drill Pipe. The Drill Collar is over *five times* as thick and—in addition—is made of heat-treated, hardened and toughened alloy steel!

OD of Collar	5¾"
ID of Collar	2¼"
Thickness of wall	1¾"
Size of Cutter used	8⅛" OD
Depth at which cut was made	6800 ft.
Size of hole	9⅝"
Length of Drill Collar removed	62 ft.

figure was recorded merely to indicate a trend. However, in the present report it has purposely been omitted since it offers opportunity for serious misunderstanding. The proved oil reserves, estimated as of any given date, cannot be withdrawn at whatever desired rate the demands of the moment may require. Oil cannot be withdrawn from its reservoirs as water can be dipped from a pond. This is a statement which may sound trite to a petroleum geologist, but it most certainly needs to be impressed on many a layman. To quote from the recently published report of the American Petroleum Institute's Committee on Reserves[6], "estimates of proved reserves do not reflect availability or rate at which these reserves can be produced with or without physical waste. For instance, arbitrary division of the known reserves by a current rate of production or by an anticipated rate of consumption is obviously incorrect. Oil in the ground cannot be produced at any desired rate for a given period of time. As a matter of fact, today's known oil can be recovered only over a period of many years and at gradually declining annual rates, as has been widely demonstrated by past performance under all kinds of operating conditions."

As we have explained, the reserves in group D might be assigned back to the year of discovery, but due to the present incompleteness of available statistics, this can not readily be done. Instead, we may regard both groups of new reserves (C and D) as directly and indirectly resulting from original wildcat discoveries. If, for each year, we divide the newly discovered proved reserves (C, Table 6) by the number of wildcats drilled in that year, or by the total wildcat footage drilled in that year, we shall have a measure of the degree of success of wildcatting in terms of newly discovered proved reserves (G and H, Table 6); and if we divide the total new proved reserves (discoveries plus revisions plus extensions; E Table 6) by the number of wildcats drilled, or by the total wildcat footage drilled, we shall have a measure of the degree of success of wildcatting assisted by outpost drilling (I and J, Table 6). Under G and H the measure is short. Under I and J, the measure may be too large or too small. In any case, there is an unavoidable error in estimating *rate of discovery*, or degree of success in wildcatting, measured in terms of new reserves; but the figures obtainable by these methods, as here described, are a significant index. As shown graphically in Figure 4, they reveal a marked drop in the rate of discovery through the years 1937 to 1942, and this in spite of a steadily increasing footage drilled in wildcats and, except in 1942, an increasing number of wildcats drilled in each year. From 109.4 barrels of new reserves discovered per foot of wildcat drilled in 1937 there has been a drop to only 21.7 barrels per foot of wildcat drilled in 1942. For all the states included in Figure 1 and in Table 1 the corresponding drop has been from 110.7 barrels in 1937 to 21.4 barrels in 1942.

STATISTICS ON WILDCAT DRILLING AND PROVED OIL RESERVES IN AREA OF ELEVEN STATES

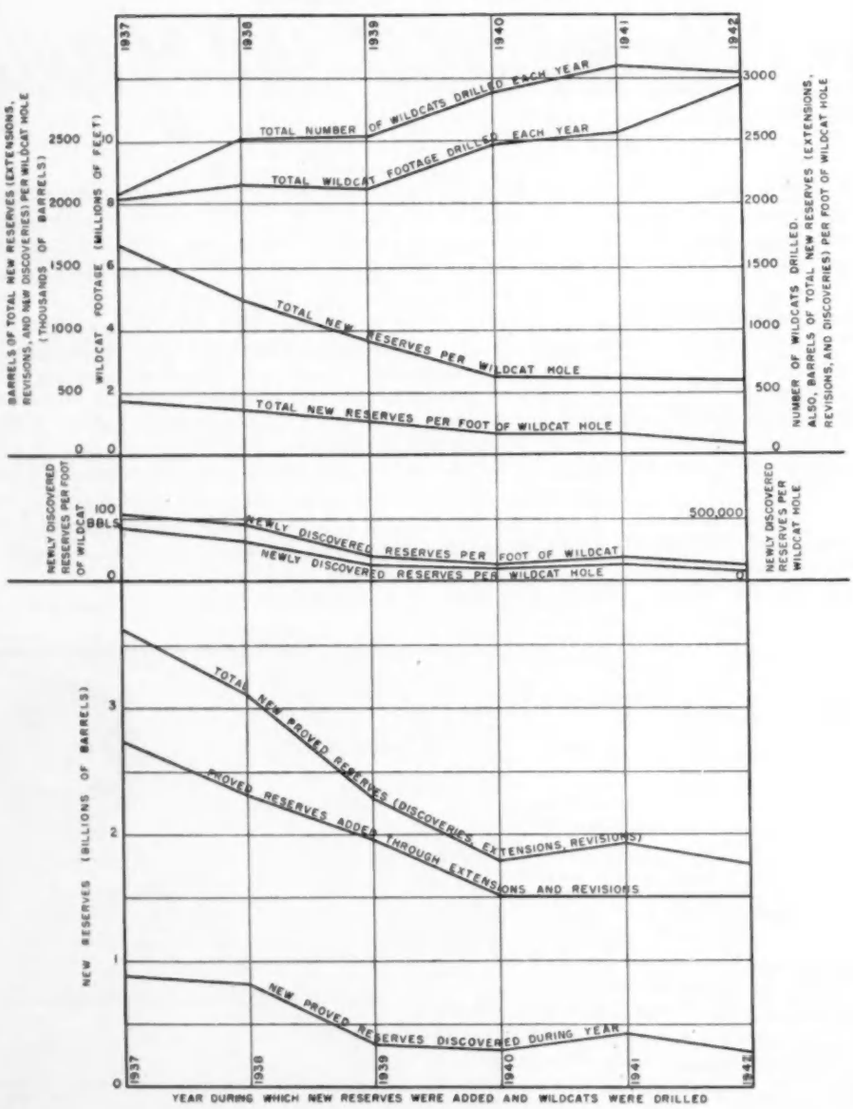
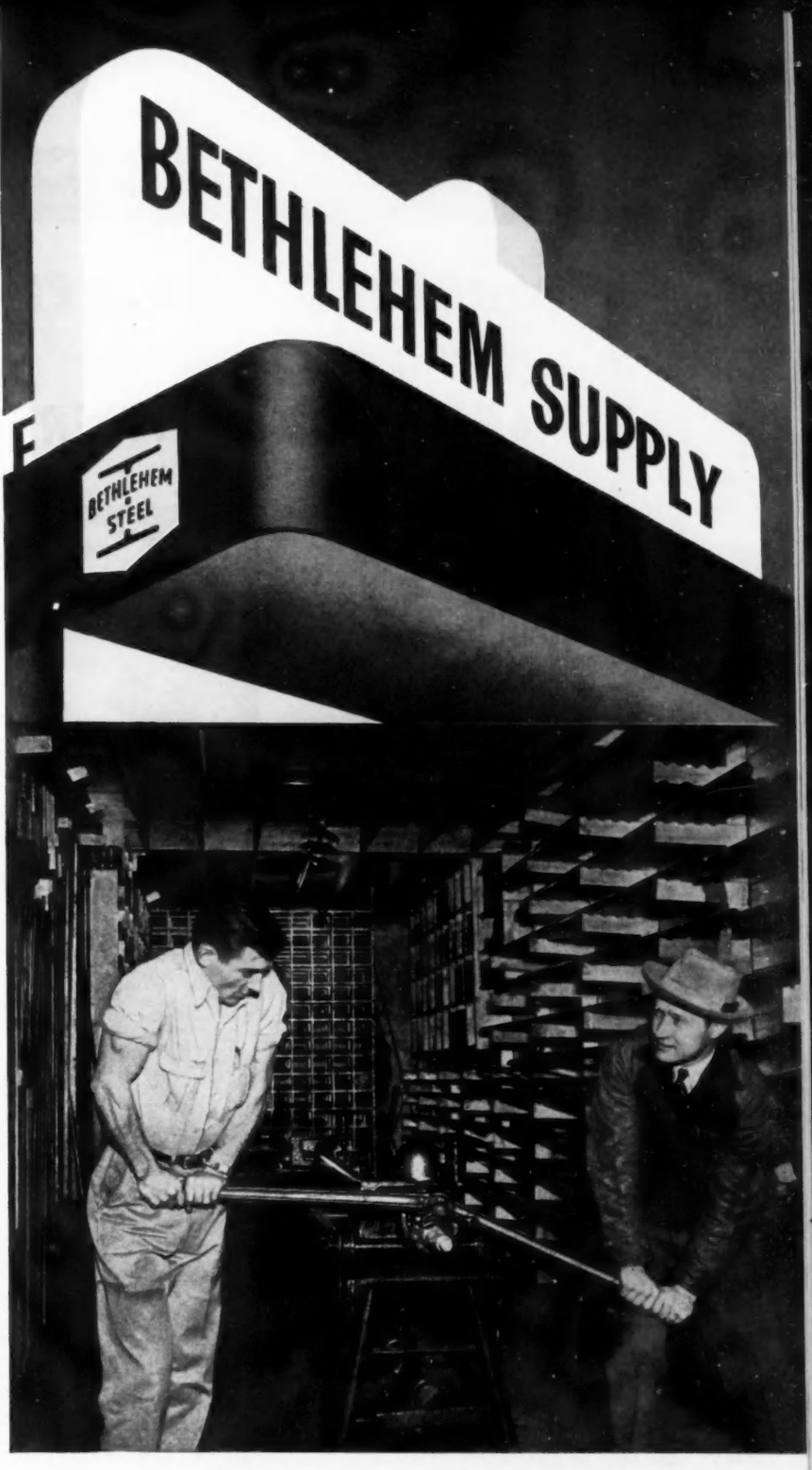

1937
1938
1939
1940
1941
1942
BARRELS OF TOTAL NEW RESERVES (EXTENSIONS, REVISIONS, AND NEW DISCOVERIES) PER WILDCAT HOLE (THOUSANDS OF BARRELS)
WILDCAT FOOTAGE (MILLIONS OF FEET)
NUMBER OF WILDCATS DRILLED. ALSO, BARRELS OF TOTAL NEW RESERVES (EXTENSIONS, REVISIONS, AND DISCOVERIES) PER FOOT OF WILDCAT HOLE
TOTAL NUMBER OF WILDCATS DRILLED EACH YEAR
TOTAL WILDCAT FOOTAGE DRILLED EACH YEAR
TOTAL NEW RESERVES PER WILDCAT HOLE
TOTAL NEW RESERVES PER FOOT OF WILDCAT HOLE
NEWLY DISCOVERED RESERVES PER FOOT OF WILDCAT
NEWLY DISCOVERED RESERVES PER WILDCAT HOLE
NEWLY DISCOVERED RESERVES PER WILDCAT HOLE
BBLS
500,000
NEW RESERVES (BILLIONS OF BARRELS)
TOTAL NEW PROVED RESERVES (DISCOVERIES, EXTENSIONS, REVISIONS)
PROVED RESERVES ADDED THROUGH EXTENSIONS AND REVISIONS
NEW PROVED RESERVES DISCOVERED DURING YEAR
YEAR DURING WHICH NEW RESERVES WERE ADDED AND WILDCATS WERE DRILLED

FIGURE 4

The seriousness of this decline in the success of wildcatting has been widely stressed, and reasons for it have been explained. The principal reason, as we stated last year, lies in the fact that new geological traps for oil are becoming increasingly difficult to find, (1) because they are fewer, (2) because they are deeper, (3) because they are associated with less pronounced geological structures, and (4) because low-permeability sands, formerly overlooked, are now being exploited. Based on experience to date we may say that, to step up the rate of discovering new reserves, an increasing number of wildcats must be drilled each year, and the holes drilled must be carried to greater depths than formerly, wherever the deeper stratigraphic section holds any promise whatever. "If we are to maintain a satisfactory discovery rate, as applied to new reserves, we must become more vigorous than heretofore in our wildcatting campaign."

These were our words a year ago. They reiterate the opinion of the entire oil fraternity. They express the warnings and recommendations of the Petroleum Administration for War, and its predecessor, the Office of Petroleum Coordinator. To heed them is of the utmost importance during this period of large and growing war demands. Then why were fewer wildcats drilled

Pumps fixed fast



Repairing a bottom hole pump at a Bethlehem Supply store.

When the bottom hole pump has gone haywire and you want to get your well on the pump again in the quickest possible time, here's a good tip to remember: Bethlehem Supply can help you out.

Centrally-located Bethlehem Supply stores are equipped to do a rush job of repairing pumps. A man who knows pumps from A to Z is always on call, not only to repair out-of-order pumps, but to help you find out what might have caused the trouble.

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Call on Bethlehem Supply for oil-field equipment and supplies, as well as pump-repair service. Bethlehem Supply stores carry a complete line of oil country supplies, equipment and spare parts. And Bethlehem Supply men are qualified by years of experience to give you helpful advice on your equipment problems, and are always glad to do so.

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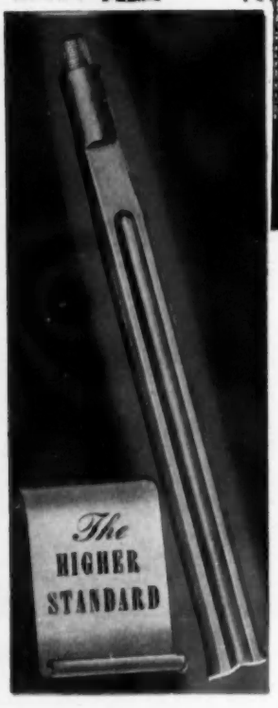
FOR SERVICE



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in 1942 than in 1941? There were several reasons. First, as is almost universally recognized by the oil fraternity, the price for crude was too low to encourage taking the obvious increased risks of wildcatting. Second was the reduction in skilled labor for drilling. Third, there was the doubt as to whether, if oil were discovered, enough pipe and other necessary equipment would be available to take care of the ensuing offset requirements and continuous-drilling requirements of the lease contract. Fourth, there was the question, in many areas, whether oil, if found, could be transported for refining and utilization. These factors have served to weaken the exploration effort as applied to wildcat drilling. And there are other factors which will still further impede the wildcatting program unless they are corrected in time. Such, for instance, are (1) the continuing reduction of technical staffs composed of those who are indispensable in the several phases of exploration for oil; (2) the deterioration of drill pipe and other equipment used in drilling, and the consequent twist-offs and breakage, especially in deep holes; and (3) concern as to the continuation of the oil man's percentage depletion allowance which serves as an incentive for wildcatting.

These factors which militate against an expansion of the wildcatting program are well known. They have been widely expounded. Their significance must somehow be driven home in the minds of those who control them and who can correct them, for otherwise it is doubtful whether enough wildcats will be drilled in 1943 even to approach the 4500 urgently recommended by the Petroleum Administration for War and by all those who realize the urgency of searching for more oil reserves. Toward this end it is essential that two facts be thoroughly appreciated — two facts which are vital to an adequate understanding of this whole problem of wildcatting and reserves. The first, already discussed above, is the fact that the rate at which oil can be withdrawn from its natural reservoir is limited; and the second is the fact that there is bound to be a considerable period of time elapsing between geological or geophysical exploration for oil and discovery of oil, and between discovery and developed exploitation.

References

[1] See A.A.P.G. Bulletin, Vol. 21, pp. 1079-82; Vol. 22, pp. 645-48, 1331-35, 1236; Vol. 23, pp. 789-94; Vol. 24, pp. 953-58; Vol. 25, pp. 997-1003, 1938, 1939; and Vol. 26, pp. 969-982.

[2] F. H. Lahee, "Wildcat Drilling in 1941 With Comments on Discovery Rate," Bull. Amer. Assoc. Petrol. Geol., Vol. 26, No. 6 (June, 1942), pp. 969-982.

[3] See F. H. Lahee, "This Matter of Estimating Oil Reserves," Bull. Amer. Assoc. Petrol. Geol., Vol. 25 (1941), pp. 164-66.

[4] Information on proved reserves is taken from the American Petroleum Institute Quarterly, in April of each year from 1937 to 1943, inclusive. Information on wildcatting is from papers listed in footnote 3, p. 969.

[5] G, Table VI, p. 978, Vol. 26, Bull. Am. Assoc. Petrol. Geols. (1942).

[6] Special release; but to be included in the Institute's Quarterly for April, 1943.

Increased Costs and Low Prices Destroying Discovery Machinery

By FRANK BUTTRAM
President, Independent Petroleum Association of America

Independents, who discover most of new fields, have grown weary of operating under 1943 costs with 1941 incomes and are selling out. Cannot expect enlarged wildcatting when prospecting machinery breaking down

A GREAT deal of time heretofore has been devoted to proving several facts about petroleum and much of that time has been wasted on the obvious aspects of the case. As a result, we now seemingly are agreed upon these very elementary points:

1. Petroleum is indispensable to the war effort.
2. We face a scarcity—now actually present in some areas—of petroleum to maintain a long-continued war.
3. Our discovery effort is lagging woefully and it shows no sign of improving; under present conditions it is unlikely that it will improve.
4. Historically, price has dictated the degree of effort exerted in wildcatting.

The industry is familiar with all the representations, pleadings and importunities that have gone into the attempt to convince the war-emergency authorities in charge of price control that the producer of oil is limited in his effort by the margin between operating costs and cash realized from sales of his one product, crude oil. The Independent Petroleum Association of America tried in October, 1941, to obtain an understanding, not only of this fact but of the necessity of building up reserves against the storm whose clouds were then lowering on the horizon. Even prior to that, warnings had been given that the machinery of discovery was losing its momentum.

Since prices of crude oil were "frozen" approximately 1½ years have passed. There has been activity on the price question all this time. Committees of the Congress have taken voluminous testimony and have gone into the oil country to obtain at first hand definite and clear-cut visualization of conditions. They have made reports plainly asserting the paucity of result that could be expected under the existing price ceiling. Army and Navy authorities, while bound by their traditional detachment to stay clear of civilian economic affairs and hence of expressions concerning price, have, nevertheless, indicated their concern over the outlook for adequate supply.

What manner of proof is required? There are warnings upon warnings, repeated almost daily in some manner, that the industry is lagging in discovery of reserves. Statements appear from those in emergency authority that it is necessary, and imperative that the number of wildcat wells in 1943 be greater than the number last year; that no effort be spared to find the needed new fields.

I wish it were that simple; that the industry could go forth and make the discoveries, of the kind and in the places now indicated as a prime necessity of the war program, responding solely to the promptings of those who sit in places that should afford them a complete understanding of all that is needed to assure victory. But the producer of oil, with no war contracts, no cost-plus arrangements, no guaranties of any kind and usually with little money—at least in the amount needed to finance one or more wildcat wells—is still painfully aware that supply and labor bills must be paid on any venture in the direction of helping the discovery effort.

Statistics Revealing

So, the result is being written in the statistics of the deficiency in discovery, of stripper wells abandoned and of secondary-recovery reserves lying idle. The several estimates of reserves found in 1942, while varying quantitatively, agree on the one important point: We did not find as much as we used. And we can disregard the seemingly impressive caliber of known reserves of 19 to 20 billion barrels. They are growing older and losing in their ability to supply the increasing demands of the war effort—a demand, we sense from the restricted estimates supplied us, that will continue to increase as the tempo of the war increases.

The February 1 issue of THE OIL WEEKLY presented a review of discoveries in 1942, giving the name of the operator who discovered each field. It is a highly significant trend that thus is revealed. The independent operator's share in the 1942 discoveries was 67 percent of the number of fields found, both oil and gas.

For several years the independent had discovered more than 70 percent of the new fields, rising to 76 and 78 percent of the total. The declining trend of his effort is an unhappy omen, both for the conduct of war and for the post-war period when restoration of our national economy will depend so greatly upon full and assured supply of petroleum.

The machinery of discovery effort is one that cannot be reassembled quickly. Its multiple parts become scattered in periods of idleness. That is occurring now. Men are leaving the producing business; weary of the struggle to meet due dates at the bank, to meet payrolls. They are selling properties to major companies. The intensive study they normally give to wildcat prospects is being dropped; the wildcatters are ceasing to assemble the blocks and to arrange, in the normal way, for financing of the tests.

Last year's wildcatting effort, in terms of wells drilled, was slightly greater than in 1940 and not greatly below that of 1941. But the trend of discovery continued down. Obviously, not enough tests are being drilled. If 3000 will not do the job, then more should be drilled. The Petroleum Administrator has called for 4500 in 1943, but one quarter of the year has gone and the revival and increase in wildcatting has not come.

The producing industry has problems

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other than price, of course, but price will resolve some of them. Competition in the labor market is not possible under current price conditions. Materials are scarce, but the independent cannot obtain his necessary share of that which is available unless he has the money. There is also the threat of attack upon the depletion allowance and the intangible-expense option which threat operates to contribute to uncertainty in planning for field activity. This is an issue which has had to be met fairly regularly in recent years.

The Petroleum Industry War Council asked the Petroleum Administrator on February 3 to recommend to the Office of Price Administration an overall raise in crude-oil-price ceilings of 25 cents per barrel. This was not regarded as the absolute figure necessary to accomplish that which must be done in stimulating discovery effort, in maintaining present reserves and in promoting secondary-recovery work. No price can be regarded today as fixed and final. An inflationary wage policy is now in motion, certain to be reflected in cost of goods. Living costs ascend, regardless of claims of vast savings effected through the price-control policy of the present war period. Too much emphasis is placed in these claims on comparisons between the present and what happened in 1918. The oil producer is not seeking a 1918 crude-oil-price level at this time and it is hoped that future relatively in prices will not compel him to seek such an extreme upward adjustment, but he cannot continue long to operate under 1943 costs with his 1941 income.

That truth, sadly, is being demonstrated every day.

Alcohol-Gasoline Blend To Have Post-War Revival

Demands for the compulsory blending of alcohol with gasoline which died down in Congress when we entered the war are expected to be revived with increased force after the end of the conflict.

This possibility was seen this week in the disclosure that the War Production Board and Defense Plants Corporation are engaged in preliminary negotiations with the Consumers Cooperative Association of North Kansas City, for construction of a 10,000,000-gallon grain alcohol plant near Keokuk, Iowa.

The plant construction would cost $1,400,000 to be furnished by DPC. It would be operated by the Farm Products Cooperative Association, a subsidiary of Consumers Cooperative.

Plans call for immediate use of the alcohol in military products, but contemplate continuance of operations after the war, with the product to be used for motor fuel, smokeless powder for farm purposes and anti-freeze compounds.

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Oil Supply Problem Demands Early Solution

[*Continued from page 56*]

covery tools as possible should always be used jointly. Any confirmation of the possible existence of a prospective accumulation of oil by several independent methods greatly increases the chances of production of the prospect. Yet, no matter how many confirmatory evidences one may have on a prospect, no absolute certainty of discovery of oil in commercial quantities can ever be given ahead of the drilling. Discovering oil will always be a matter of probability, chance, and gambling.

Who Shall Be the Wildcatter?

Exploratory oil-well drilling, even in the *structural* stage, is still a hit or miss proposition with an average number of 1 hit to 10 misses. At the present low price for crude oil (60 percent of the average during the base year of 1926), with the small size of the fields presently found (about 1 million barrels per find) and with such odds against them, it is a wonder that so many oil men have kept on pitting themselves in a gamble against mother nature. There is no escaping the fact that wildcatting will continue to be a "gambling" proposition and, in the stratigraphical stage of oil prospecting, the odds against success will even be greater though the rewards may be higher.

Influence of Profit Opportunities

Presently the small independent operators and companies account for three quarters of the oil fields discovered. This is in keeping with the psychology of the gambler that the smaller the cash reserves he has, the longer the chances he will take. A large company which has to give account of its operation to a wide variety of shareholders can ill afford to venture too deep in the exploration game as it often proves more profitable and safer to purchase fields discovered by the small operators.

Some have proposed that the government should financially participate in a wildcatting campaign, but the government must give account of its operation to all the people and therefore can not efficiently participate in a gambling venture.

If the oil industry is to survive through the medium of adequate discoveries, action must be taken to encourage the gambling spirit of the wildcatter as there naturally is not sufficient altruism among business men to expect them to look actively for new fields without hopes of substantial financial returns. The profit motive and the expectation of large and quick financial rewards have constituted in the past the spark necessary for the active prospecting campaigns, and more particularly for straying from beaten paths, which often proved successful in opening new territories. Presently, the wildcatter must wander from the structural path, at least in the known petroliferous provinces though he may yet apply structural exploration in undeveloped but potential oil provinces. In any case he must be venturesome enough to look beyond the horizon of present-day practices.

In the pioneering stage of the stratigraphic-prospecting campaign in old provinces and of the exploratory campaign in new regions some incentives as well as a lowering of the barriers and red-tape must be provided by responsible government agencies. Certain incentives in the way of bonus for discovery wells, subsidies or compensations for dry holes have been proposed but are looked upon with disfavor by business men. More welcome would be an increase in the depletion allowance, a higher price for crude oil more in keeping with the average price of other commodities, the allowance of large production to discovery wells but compatible with good engineering practices, exemption from taxes on the profit made from discovery wells, and several other possibilities.

Among some impediments which exist in the path of an active exploratory campaign may be listed:

1. The limitation of personal income, as the small successful operator, who is also the wildcatter, may not want to exert any efforts on a promising prospect if, early in the year, he has already accumulated a profit of such magnitude that further work would be wasted time from his own financial point of view.

2. The human relation, some of the most aggravating and time-consuming obstacles in the path of the rapid development of prospects consist in the human relation aspect of the development. The laws of the country being such that the owner of the surface owns the mineral rights, a lease must be secured from the owner and one non-cooperating and stubborn farmer may indefinitely postpone the development of a valuable prospect. Dealings and bargainings must also be had among companies owning adjacent leases and some of these may be just as recalcitrant as a stubborn farmer. In other instances, titles are so clouded on drilling prospects that the operator shrinks at the amount of legal work involved. One could cite at length examples of unnecessary delays in exploratory drilling which could be avoided by a general application of the law of eminent domain, thereby expelling the non-cooperator, since public interest is at stake. Equities could be settled later rather than before drilling. The remedy may seem drastic but the shortage of oil may become a major national danger.

Centralized Control Needed

Although the above recommendations would facilitate the exploration for oil and render it less time consuming, it is also believed that it should not go unguided nor unregulated during wartime.

Wildcat drilling is the only activity of the oil business which seems to have escaped the long and heavy hand of government control and regulation, whereas it is the opinion of some leading men in the industry that it is one of the activities which is in greatest need of guidance, orientation, and control. One can ill reconcile the granting of unrestricted free allowance of critical material and equipment to a promoter who drills a well on hunches and dreams. To be sure, about 1 of such wells in 25 will discover 1 field on the average, but this will result in the waste of many tons of steel and manhours of work whereas by the application of proper geological and geophysical methods one similar field could have been discovered by drilling, on the average, only 3 or 4 dry holes thereby wasting only a few hundred tons of steel and a relatively small number of manhours. A further disadvantage of free and unguided wildcatting is that the operator will most often drill exploratory wells in regions already under active development where an excess of crude oil exists. Presently, there is great need for discovering crude oil where it is strategically located with respect to refineries, markets and pipeline outlets such as the North East, Michigan, Illinois, Indiana, the southern Atlantic Coast, California, and the Pacific North West.

A centralized plan and control of exploratory drilling should, therefore, be considered by governmental authorities, possibly along the following suggested lines:

1. Make available to the industry large-scale geological studies, particularly in the strategic regions here above mentioned. This information should include stratigraphic, paleogeographic and structural studies pointing out the horizons likely to act as reservoir beds, their distribution and possible truncation on recognized structural features. This would merely result in an intensi-

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fication of the present work of the United States and state geological surveys.

2. Make available large-scale reconnaissance-prospecting surveys of the same regions such as subsurface geological maps, convergence maps, isopach maps, and geophysical maps, magnetic, gravimetric and seismic surveys.

This would require the enlistment of the cooperation of the industry and reluctance will no doubt be encountered in releasing confidential data acquired at great expense. Yet, many surveys are now obsolete and no doubt a measure of success may be achieved when it is pointed out that mutual benefit will be acquired by an exchange of information.

If necessary, new reconnaissance surveys should be filled in at government expense in order to clear up some points of broad geology.

3. To private enterprise should be left the initiative of making detailed geologic and geophysical surveys of promising areas (but avoiding duplication of effort as much as possible), and to acquire leases and royalties.

4. Before exploratory drilling be permitted, the wildcatter should submit evidence that he has secured sufficient corroborative confirmation by various exploration methods. The machinery for issuing wildcat-drilling permits can perhaps best be vested in the state geological survey with review by federal agency. As long as steel, drilling equipment, and manpower are critical, it is reasonable that only those wells having a high probability of success should be drilled.

Conclusions

Some of the suggestions made herein may have been drastic, but the problem is also a serious one.

The danger of the situation resides in the fact that, except for regional shortages of oil, there is not as yet a general dearth of the raw product; this is only to be felt in a future probably not too distant. We can meet presently all the military and civilian demands, and present regional shortages are merely a problem of transportation. Yet, with the mounting needs of the military operations as well as of essential civilian uses it is estimated that the average daily production for the current year may have to be raised 400,000 barrels. This flush increase can be met for a while by those flush fields now drastically curtailed (provided pipeline facilities are available), but before long the problem of supplying the essential demands is bound to become one of production if sufficient productive capacity is not added by newly discovered flush production.

As in the past, the oil industry must keep pace with the demands not so much by drawing on its reserves as by supplying new flush fields. We must not add another major blunder of war management to Pearl Harbor and the rubber shortage by failing to solve the paramount problem of oil sufficiency. Steps must be taken now; tomorrow will be too late as the fruits of a wildcatting campaign are reaped with a delay of one to three years.

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In addition to forming the backbone of this major distribution system, pipe and tubes of special grades make possible the ceaseless 24-hour grind of refinery operations. Here they serve as crude supply lines, high temperature and high pressure lines, cracking still tubes, and in many other services, all geared to one dominant consideration—maximum production for our fighting forces.

All in all, Uncle Sam's oil industry is doing a grand job in the war program. It is not only supplying many of the United Nations, but is producing oil and gasoline for certain of our civilian uses, too. This achievement is not duplicated anywhere else in the world. Congratulations to America's oil industry!

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Surface Analysis Can Now Tell Hydrocarbon Source

By HOMER HENDERSON
Surface Analysis Company, Houston

THE next few years likely will see a great deal of exploration for oil. The nation will be in need of large quantities. This situation, coupled with diminishing discovery rates, creates a need for a prospecting method that will have good finding power and will not consume large quantities of needed war materials, and which will be low in cost to fit wartime economy. Improved miscroscopic surface analysis gives promise of being that method, if conducted with proper technique and by experienced personnel who have knowledge of the geological, physical and chemical fields involved. The stratigraphic trap is generally believed to be the big hope for additional oil supplies in the United States. Surface analysis is unique in the prospecting field in that it will locate stratigraphic traps which have no anomalies in the physical fields of gravity, magnetism or seismology.

There has been considerable study of microscopic surface or soil analysis in the United States for the past 8 years. The results of this work have varied, but considerable progress and improvement have been made. No doubt additional advancements will be made in the use of the method. For example, only recently has a method been developed which differentiates between vegetable waxes and the hydrocarbons diffused from underlying petroleum. This has been one of the serious drawbacks to the use of soil analysis.

The oil industry has always considered surface concentrations of hydrocarbons such as oil springs, gas seeps, and paraffin earth as surface indications of oil at depths. That these have been reliable indicators is shown by the fact that in one geologic province alone they are credited with the discovery of 75 out of 219 domes discovered prior to 1936. These indicators are, in fact, soil-analysis methods. Since they were normally detected by visual observations, with the naked eye, they are considered macroscopic in detail.

In view of the success acquired by these macroscopic soil-analysis methods, it would appear logical that microscopic methods might reveal hydrocarbon surface deposits not discernible to the naked eye. In many Gulf Coast fields the discovery well was drilled because the surface hydrocarbon concentration was sufficient to give the so-called "paraffin earth" indication, which is characterized by the cessation of vegetable growth and with the soil having an art-gum texture. It is reasonable that as the degree of hydrocarbon concentration becomes less and less, a point is reached where the concentration can not be observed with the naked eye, but can be detected by chemical means, or physical instruments, or by a combination of the two. It is also reasonable that these low-degree surface concentrations of hydrocarbons may be just as indicative of oil at depth; but possibly at a greater depth or in a reservoir having tighter overlaying formations.

The literature discloses that several investigators have explored in this microscopic soil-analysis field. The earliest reference being a German patent filed in 1921. In this country, H. E. Minor, in 1924, analyzed near-surface waters for salinity and outlined the subsequently proved prolific Tomball field in the Gulf Coast. Minor was followed by G. Laubmeyer in 1929, analyzing for methane and ethane in surface soils, and he found that in relatively high concentration in the surface soils indicated petroleum at depth. In Russia, starting in 1932, a group of investigators carried on a series of measurements of hydrocarbons in surface soils. They separated the hydrocarbons into fractions and were able to correlate high concentrations of the lighter fractions, such as methane and ethane, with gas at depth, while high concentrations of the heavier hydrocarbons correlated with oil at depth. The considerable work done in this country on microscopic analysis since 1935 has been performed by private investigators, consulting geophysical companies, and the research departments of the major oil companies. The success of these investigators has been varied. All agree, however, that hydrocarbon molecules do leak off from subterranean petroleum deposits and slowly but continuously rise to the surface. There is not such an agreement on the process by which these hydrocarbons filter to the surface, being variously termed diffusion, effusion and permeation with some investigators contending that it is a combination of all three processes.

There are many instances in nature similar to this leaking-off process. The phenomenon of osmosis, so necessary to life of every living cell, animal and vegetable, is very similar. This selectivity is accomplished in some membranes by a porosity so small as to pass the small molecules but not sufficiently large to pass the undesired molecules or particles.

That a gas will diffuse into a dense metal is spectacularly shown by palladium which will absorb 960 times its own volume of hydrogen. It is known that methane will diffuse through glass, and a section of iron pipe removed from a gas line will emit a strong odor of gas for years due to the gas-diffusing back-out of the metal. Air diffuses through the rubber of an automobile tire. Hydrogen or helium diffuses through the cells of balloons. Sir Roberts Austin has shown that metal will diffuse into metal, by demonstrating that when gold and lead plates are properly prepared and placed in intimate contact, they will slowly diffuse, one into the other.

It is probable that the leaking off of the hydrocarbons from the oil reservoir is a combination of diffusion, effusion and permeation, but largely one of diffusion.

Other things being equal, the rate of diffusion will be in an inverse ratio to the thickness of the reservoir seal, the depth of the reservoir. This being true, it would be expected that shallow fields would result in greater surface concentrations of hydrocarbons than deep fields. This has been observed to be true. This may be one of the chief reasons that shallow fields have, usually, a low-gravity oil, due to the fact that the volatile constituents (small molecules) have escaped to the surface during the immense amount of time involved. In this connection, it can be shown that the

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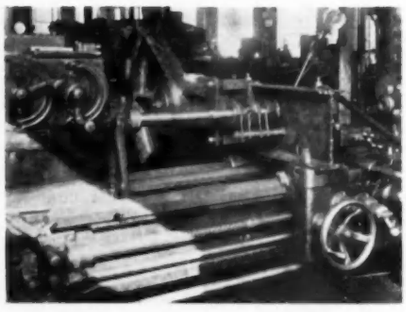
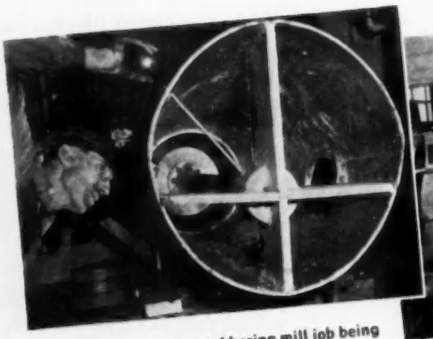
● A milling machine with special rigging machines odd-shaped parts that would have required several separate machining operations and welding.

● A slotting machine with small electric motor attached to drive the cutter, takes the place of a milling machine on this job.

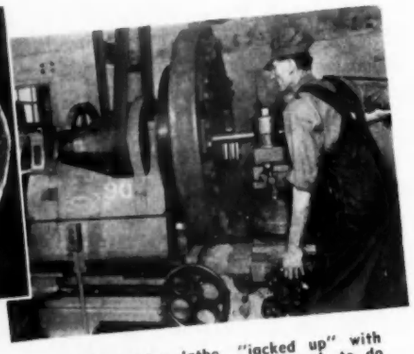
O-C-T proudly flies this prized Treasury Flag because 100% of its employees are buying war bonds and stamps.



● Engine lathe with improvised fixtures and I-beam extensions being used on a drill press or milling machine job.



● A difficult horizontal boring mill job being done on an engine lathe. Note how raising blocks lift the spindle so that the job will clear the carriage.



● This engine lathe, "jacked up" with raising blocks, is now big enough to do the job that would ordinarily have been done on a boring mill.

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smaller molecules will diffuse more rapidly than the larger molecules, with the molecules that are liquid at reservoir temperature diffusing very slowly indeed.

The tightness of the reservoir cover (overlaying formations) will influence the rate of diffusion to a marked degree. The recent unconsolidated formations permit a much more rapid rate of diffusion than the older more consolidated ones. A friable shale with long interatomic distances will pass more gas by diffusion than a dense compact limestone with short interatomic distances. It is apparent that the nature of the geologic section will influence the hydrocarbon surface concentration.

The rate of leaking off of the hydrocarbon gases will also be influenced by the pressure gradient, the temperature, the viscosity of the gas, and the permeability of the overburden. The retention of the hydrocarbon-gas molecules at the surface will be a function of the absorption characteristics of the surface formation. It is seen that several factors influence the concentration of hydrocarbons over an oil reservoir, and consequently, even though soil samples are properly taken and correct interpretation of the data requires information on a multiplicity of conditions, some of which are not always available.

A further obstacle in the path of soil analysis is the large quantities of hydrocarbons generated by decaying vegetable matter. Most of this is methane, so well known as marsh gas. Both living and decaying vegetable matter give off ethylene. It has been demonstrated by B. Renault that plants of low order will yield an oil similar to petroleum when distilled. It is generally accepted today that aneaerobic bacteria can alter cellulose into organic waxes and fats. It is important that the method used for analyzing the soil samples differentiate between these vegetable oils and the hydrocarbons from the petroleum reservoir. This is extremely difficult by chemical methods. The chemical isolation of a single fraction of petroleum often requires many months and is sometimes impossible. It has been contended that the solution to this difficulty is to take samples below the depth of the vegetable zone. This in a sense handicaps the survey, because of the following: As the various types of hydrocarbon molecules leak to the surface certain unsaturated types react at the surface (oxidation, photosynthesis and polymerization) to form solids or waxes similar to the thin surface formation known as paraffin earth. These waxes accumulate during the enormous times of geology. It is important that these accumulations be measured, rather than the relatively few molecules that might be in process of diffusing through the

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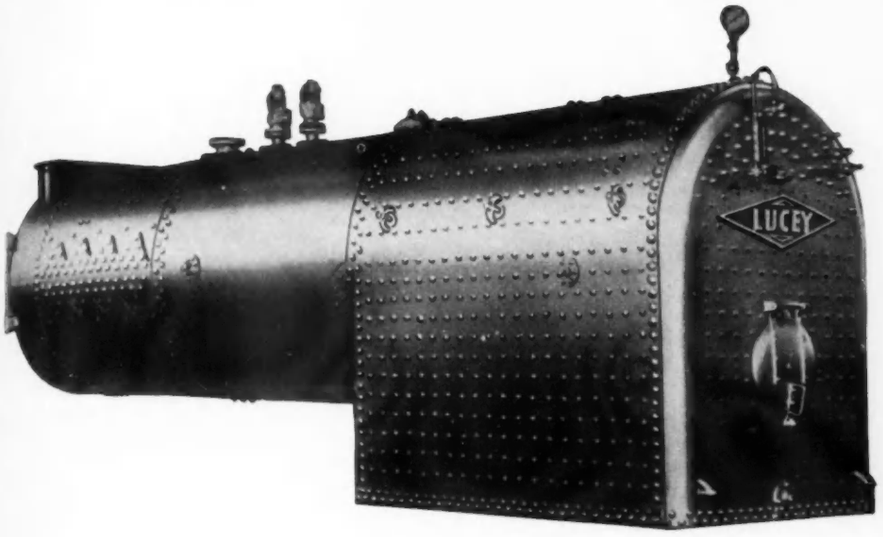

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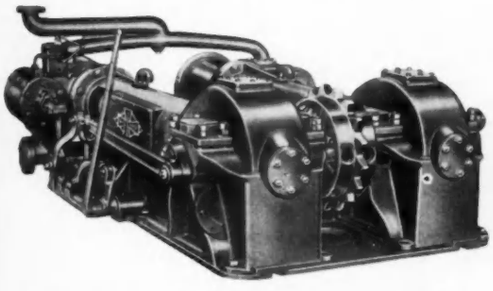

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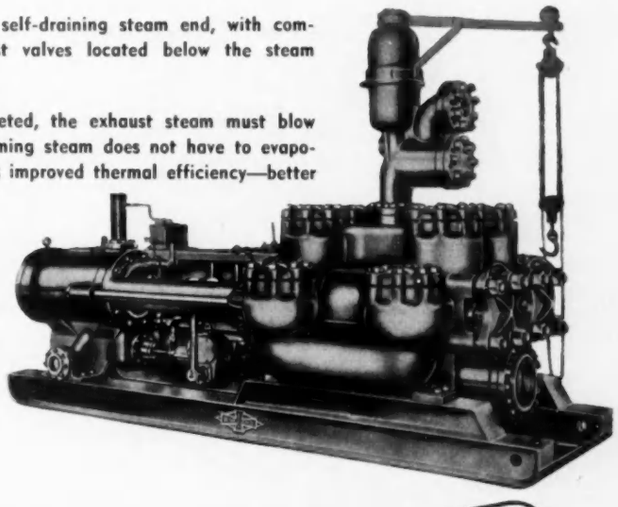

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subsoil at the time of the soil analysis survey. It is a much better solution to use a method that differentiates between vegetable waxes and the hydrocarbons that diffused from petroleum at depth.

There has been developed a physico-chemical method that will do this.

Using this method, it is possible to make a very useful tool of soil analysis, but it must be operated by personnel who have a knowledge of the geologic, chemical, and physical fields involved. In addition to the precautions mentioned above, a relatively new alluvial deposit, for instance, will not have had time for hydrocarbon wax accumulations and high concentrations should not be expected. Man-made fills are similar. The field men as well as the laboratory personnel must be on the alert for artificial contamination with petroleum.

Figure 1 shows an idealized section of an oil reservoir, showing the diffusing molecules by arrows. The dotted profile shows the values of hydrocarbon concentrations as measured by the surface-analysis survey. It will be noted that the values increase materially over the oil reservoir. In most areas there is usually a slight concentration of hydrocarbons. This can be explained by the irregularities of the formation sand surfaces giving in effect very small traps of little area from which a slight amount of diffusion occurs, but cones out to such an area that the surface concentration is slight. In such areas nearly every well gets a small "show" even though not a producer and not on a structure.

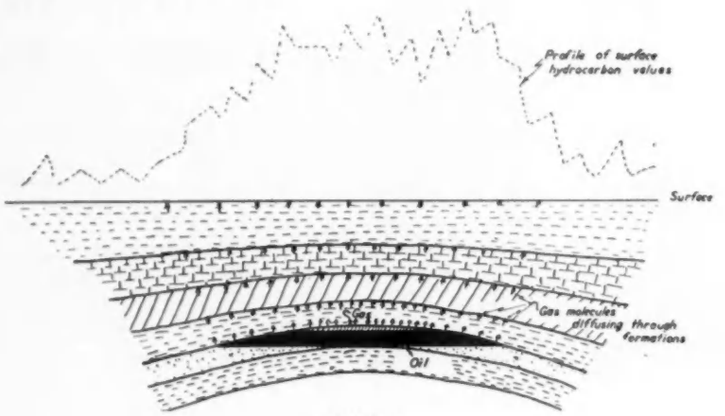


FIGURE 1

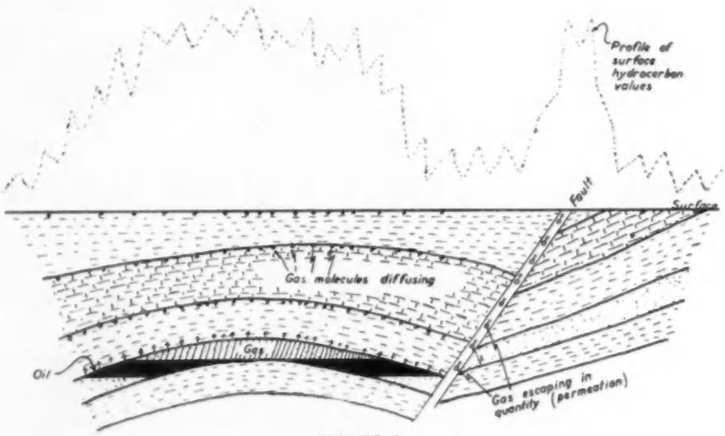


FIGURE 2

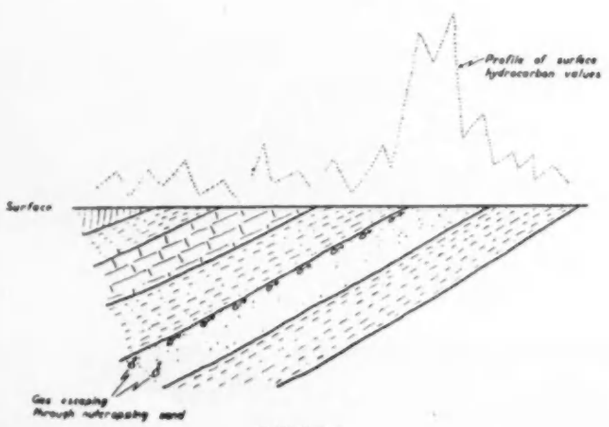


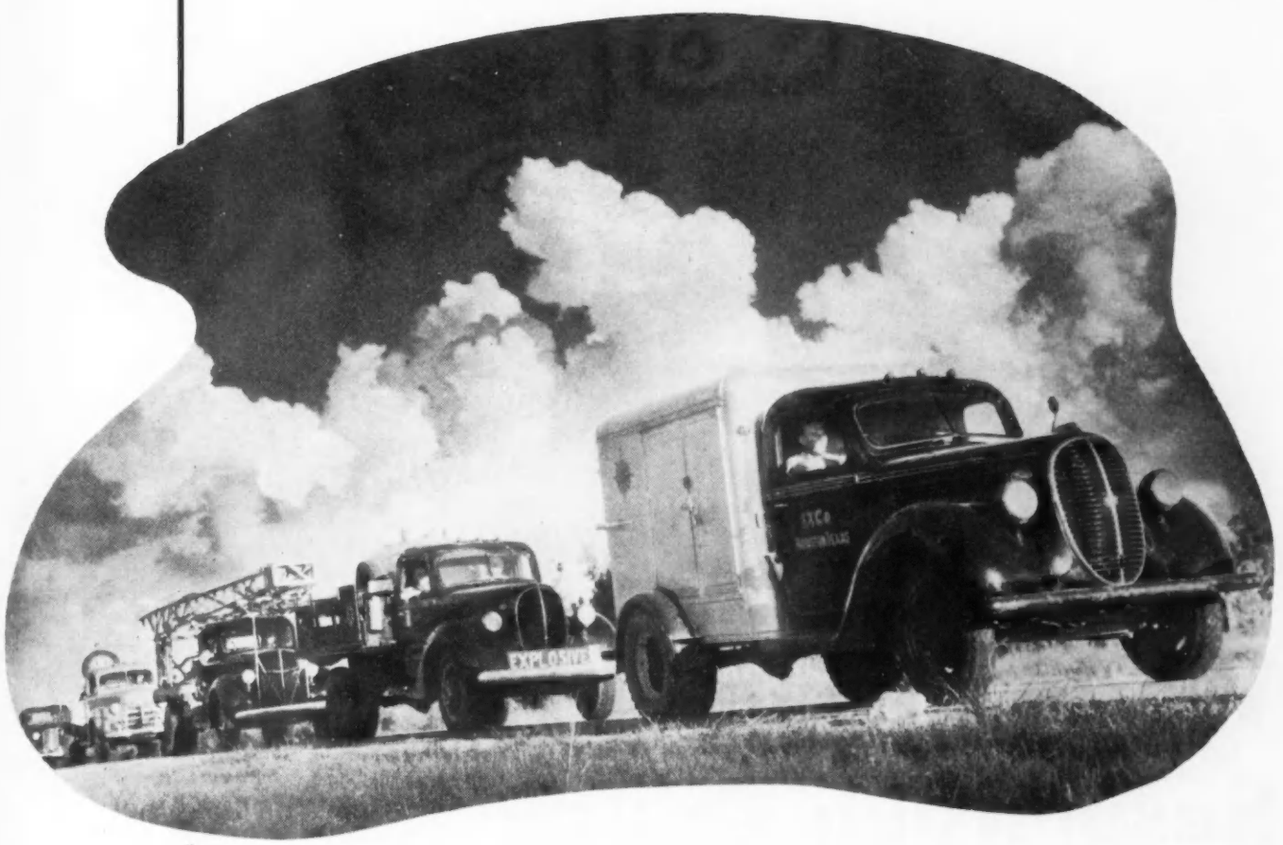
FIGURE 3

Figure 2 shows a fault in conjunction with a petroleum reservoir. In certain types of non-sealing formations the gas, and sometimes oil, will migrate up the fault plane through relatively large fissures. This migration may be a permeation or flowing and at a much faster rate than diffusion. This may result in large hydrocarbon concentrations where this fault cuts the surface, or near surface. An alert operator, however, will observe that the configuration of the concentration is long and narrow and will suspect the true cause and will use the information in looking for production along the fault.

Figure 3 shows a condition where a sand outcrops. Under certain conditions, petroleum hydrocarbons can gain access to this sand and, seeking its gravitational level, migrate to the surface by permeation. This, too, can be at a rate much faster than diffusion. It may result in a long band of high hydrocarbon values somewhat wider than in the case of a fault, an experienced operator will observe that it follows the contour of the downdip contact of the sand outcrop.

Surface analysis now meets most of the qualifications that the industry's current position makes desirable in a prospecting method. There is need for a rapid discovery method if the industry is to increase its producing capacity sufficiently to keep abreast of accelerating consumption, and the rapidity with which surface-analysis surveys can be made makes it possible to inspect large regions quickly. It also is inexpensive, thus keeping in step with economies demanded by wartime price ceilings and higher operating costs. Neither does it use large quantities of critical materials required by the nation's war effort. There may remain some doubt as to its finding power, but the development of a method whereby it is possible to differentiate between gases diffused from vegetable and petroleum deposits is an important advancement in this respect.

This Crew knows how to do the job!



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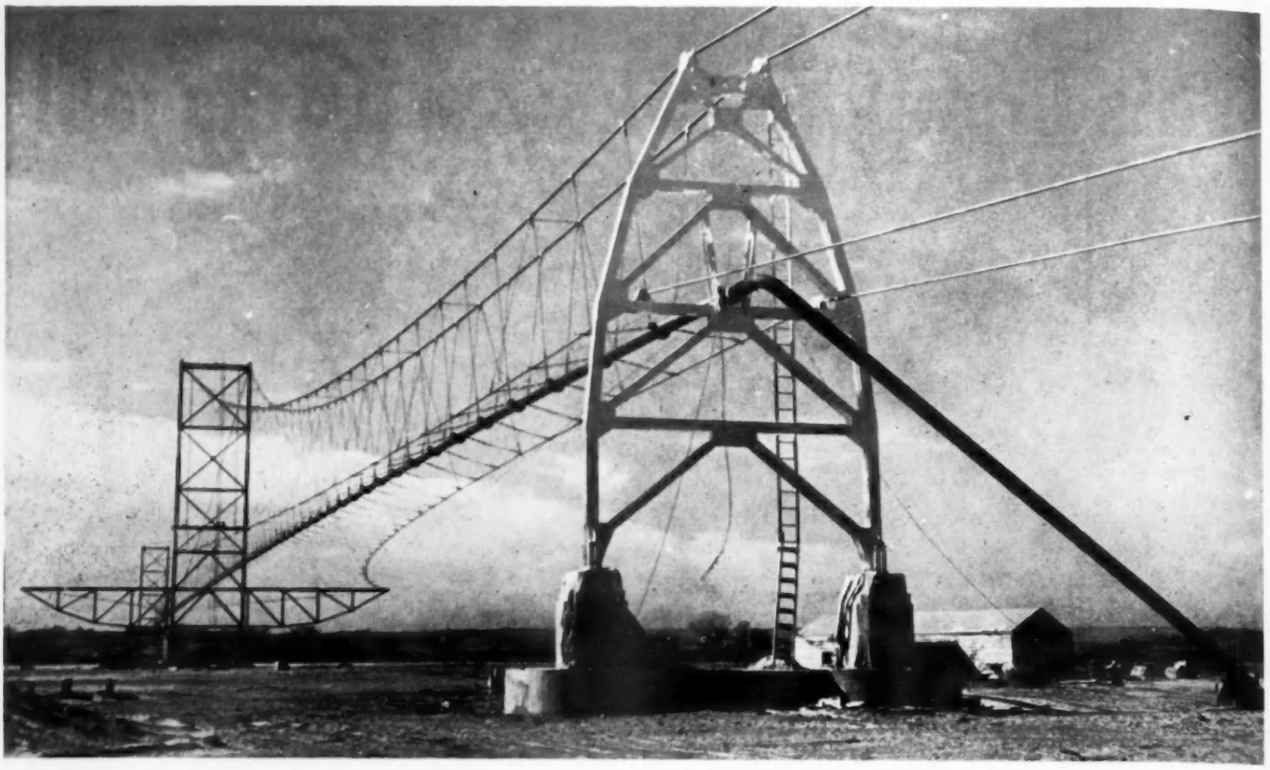


World's Longest Pipe Line Suspension Bridge

By DON B. BOYDSTON
Engineer, Oklahoma Natural Gas Company

Span is longest in world to use multiple-strand main cable construction. Horizontal deflection of line due to wind prevented by special system

OKLAHOMA Natural Gas Company recently has completed a pipe-line-suspension bridge across the South Canadian River near Norman, Oklahoma. An outstanding feature of the bridge is that it contains the world's longest pipe-line-suspension span.

With respect to span length only, the bridge ranks fifth among the larger suspension bridges of the world, regardless of their use. Only the Golden Gate Bridge at San Francisco, the George Washington Bridge at New York, the Oakland Bay Bridge at San Francisco and the Ambassador Bridge at Detroit contain longer suspension spans. The Narrows Bridge at Tacoma contained a longer span when it was in service.

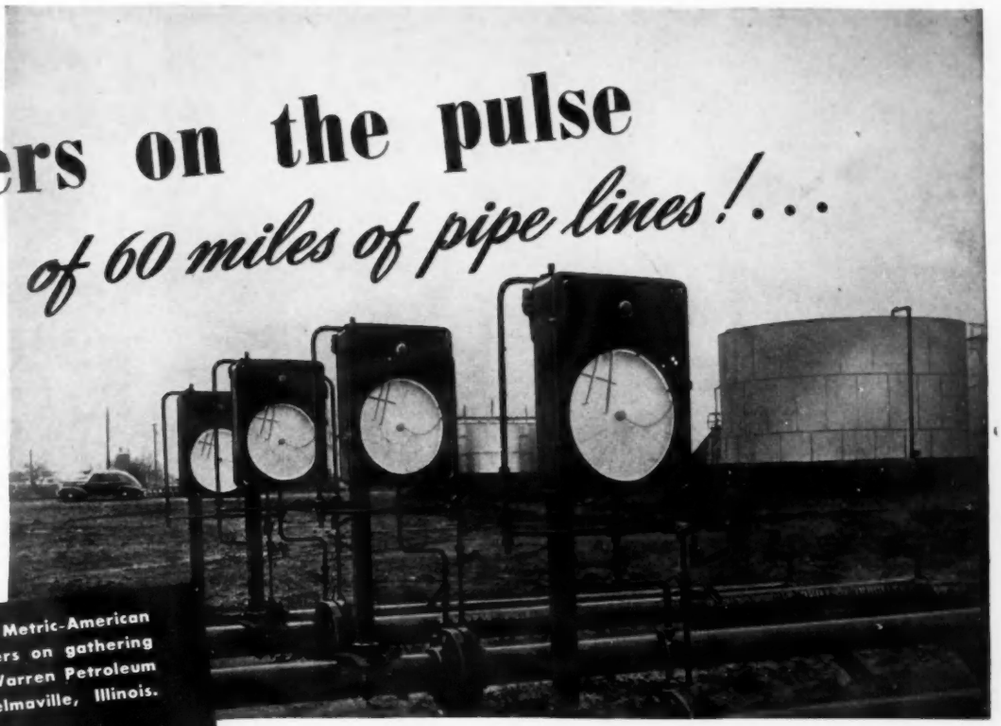
Another distinction for this bridge is that it contains the longest suspension span in the world using multiple-strand main cable construction. That is, instead of winding a complete cable, seven smaller cables were laid parallel and wrapped with wire to bind them into a unit.

The bridge as designed by Wilder Kenan of Matthews & Kenan, San Antonio, Texas. Kenan has a number of similar bridges to his credit. It was erected by Pittsburgh-Des Moines Steel Company of Des Moines, Iowa, under the general supervision of Gordon Lunt, bridge department manager, and the immediate field supervision of Griffith E. Brogan, engineer, and L. H. Heidbreder, field superintendent. Construction required about 11 months, although the bridge was ready for gas transportation in 8 months.

All field engineering was furnished by Oklahoma Natural Gas Company. This included the original layout of the bridge elements and engineering and inspection during construction. Since all cables were cut and socketed before being shipped to the job, it was necessary to use the utmost care and accuracy while making the original survey. As construction progressed, constant checks were made on the quality of materials, location of units and deviations from specifications so the completed bridge would duplicate the original plans as nearly as possible. The resident engineer acted as the agent of both Kenan, the designer, and the Oklahoma Natural Gas Company.

Physically, the bridge contains 1½ spans. The main span is 1760 feet long and crosses the bed of the river. The half span is 880 feet long and crosses

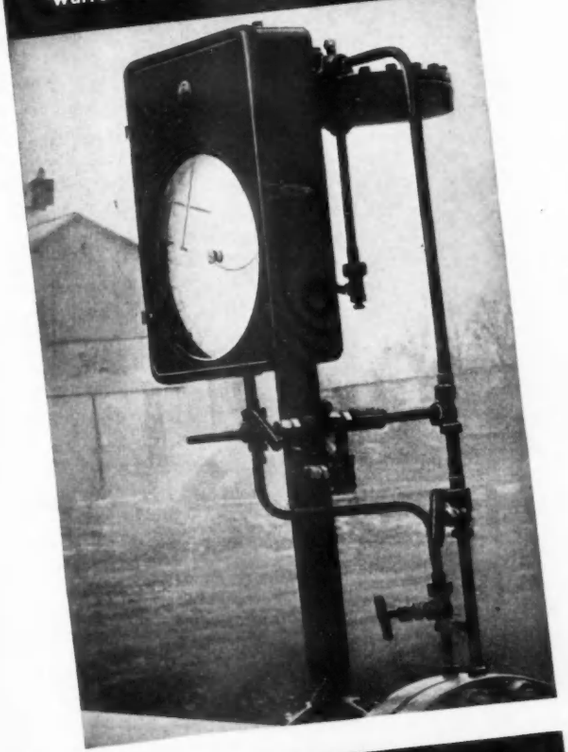
fingers on the pulse *of 60 miles of pipe lines!...*



Central meter setting of Metric-American Recording Orifice Meters on gathering system of gas at the Warren Petroleum Corporation plant, Selmaville, Illinois.

•

Typical gas field line application of Metric-American Recording Orifice Meter, at Warren Petroleum natural gasoline plant.



Out in the famous Salem Oil Field, the Warren Petroleum Corporation is demonstrating to the industry new wrinkles in the recovery of iso-butane and other products . . . in big-scale operations.

◊ **Scores of METRIC-AMERICAN Orifice Meters of the "Westcott" Recording type—installed on field and gathering pipe-lines — accurately meter the vast flow from more than 700 wells . . . some 20,000,000 cubic feet of gas delivered daily to Warren's modern new natural gasoline plant.**

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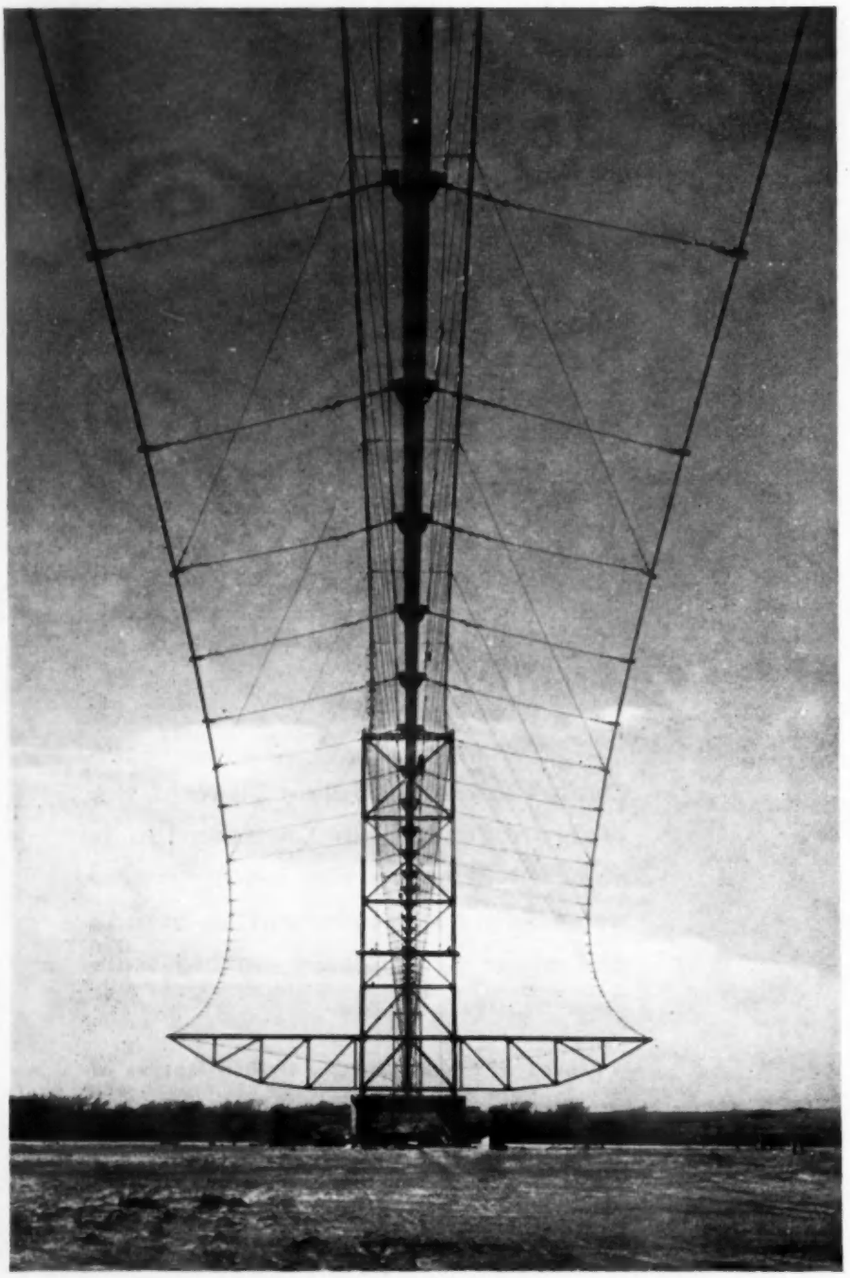
AMERICAN METER COMPANY

INCORPORATED (ESTABLISHED 1836)



View from underside of back span, showing wind cables.

the possible future river course, should it ever change. Pipe is suspended across both spans, or a total distance of 2640 feet. Total extreme length of the bridge is 3698 feet. The pipe clears the river bed approximately 50 feet at the center of the main span.

The anchors are of reinforced concrete. Cable geometry required that one large anchor be used at the half-span end of the bridge and two smaller anchors be used at the other end. The large anchor contains approximately 400 cubic yards of concrete. Because it is in a possible future high-water course, sheet piling was driven around it. Each of the smaller anchors contain about 200 cubic yards of concrete.

Three steel towers support the cables. Two of them, located at each end of the main span, are 143 feet high by 36 feet wide and have wind cable supports extending 77 feet horizontally from their sides. These towers reach a height of approximately 165 feet above the normal river bed. The third tower, identified as the rest tower, is located at the bottom of the main cable sag at the end of the half-span. Since the main cable sag is 110 feet, this tower is considerably shorter than the other two. All towers are of riveted structural steel.

Foundations

Foundations for the main and rest towers are reinforced concrete cassions, 12 feet outside diameter by 8 feet inside diameter. They extend down through the sand bed into the structure known as the red-bed, a dense red shale. They were sunk in the conventional manner. Each caisson had a steel cutting edge at the bottom and was poured and lowered in 9-foot lifts.

Through the upper sand bed the caissons were sunk by removing sand from the center with a derrick and clamshell. The pressure of water was not detrimental to this method. However, the red-bed had to be excavated manually so it was desirable to shut the water off when the caisson reached that depth. To secure the desired water seal, a 225-ton load box was erected on each caisson as it neared the red-bed. The purpose of the load box was to cause the cutting edge to penetrate the red-bed ahead of the excavation so that water would be sealed out. Results were satisfactory. The caissons were kept sufficiently dry by pumping and bailing so that it was not necessary to sink the caissons pneumatically. However, provision had been made in caisson construction so that air pressure could have been applied if necessary.

After the caissons were landed at their proper depth in the red-bed, which was as much as 45 feet below the river bed in some cases, a cylindrical hole of a diameter two feet less than that of the caisson was excavated to a point four feet below the cutting edge. This served as a key in the red-bed. A concrete seal course was then placed in the bottom of the caisson, using a tremie. The caisson fill course was a lean concrete mix.

The steel towers were erected on the foundations with a 110-foot guy-mast derrick. Since the main towers extended 160 feet above the base of the derrick, it was necessary to make other provisions for erecting the upper third of the steel. To meet this necessity, the steel company built sockets into one of the upper steel tower members. A supplementary boom was rigged into the socket to complete erection. The towers were completely erected in the usual manner, using bolts and drift-pins before riveting. The wind arms were completely assembled and riveted on the ground, then hoisted into place and attached to the towers as complete units.

Built-Up Cable

As previously mentioned, each main cable is composed of seven 1⅛-inch cables placed six-about-one but not wound. The resulting 3⅜-inch cable is held together as a unit by the cable clamps and a wire wrapping. The wrap-

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1. **Improper or insufficient lubrication**
2. **Using wire rope of incorrect size, construction or grade**
3. **Improper selection of sheaves**
4. **Improper care of sheaves**
5. **Sheaves out of line**
6. **An inadequate factor of safety**
7. **An excessive fleet angle**
8. **Sudden jerks or pulls**
9. **Kinking**

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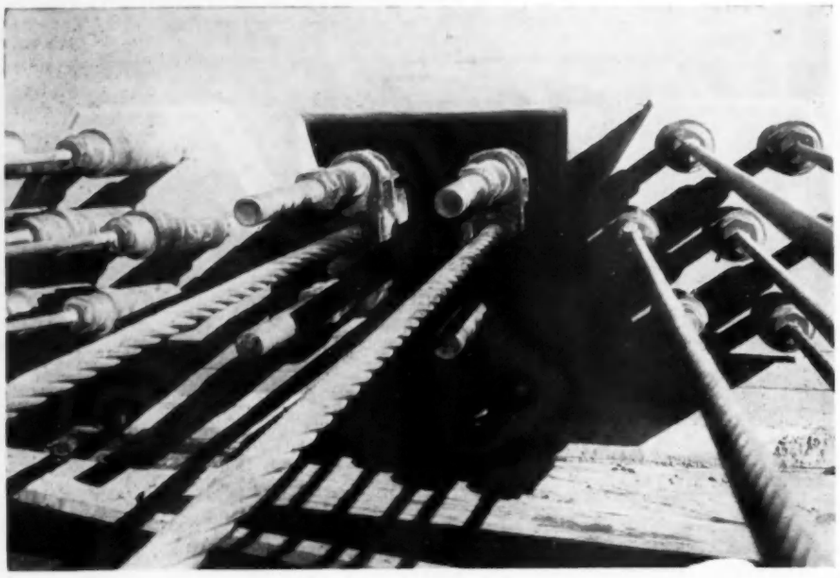


Face of anchor, showing cable attachment.

ping wire has a pitch of one inch and was applied with a special rapping tool which maintains the pitch constant and keeps an even tension of 100 pounds. The wrapping device is a patent of the construction company. Each cable was pulled separately, wrapping being done after all cables were in place.

The largest single cables on the bridge are the 2¼-inch wind cables. The wind-cable system, a patent of Kenan, is designed to prevent horizontal pipe deflection due to wind. The system is designed to withstand load similarly to the main cables except in a horizontal plane. The wind cable has a horizontal sag of 88 feet. The support arms extend out 95 feet from the center line of the bridge, and are hinged to the towers at the connection points.

All cables are galvanized and were cut to length and socketed or fitted before being shipped to the bridge site. To prevent later bridge distortion due to stretching, all cables were prestressed before cutting.

The 12-inch pipe was welded and pushed on the bridge from suitable platforms. To keep the main cable deflections symmetrical and thereby keep the pipe cradles in line, the pipe was pushed in three directions simultaneously. Considering the bridge as being three half-spans, the pipe was pushed so that all three were loaded simultaneously from the high to the low portion of the main cable.

Welded Pipe

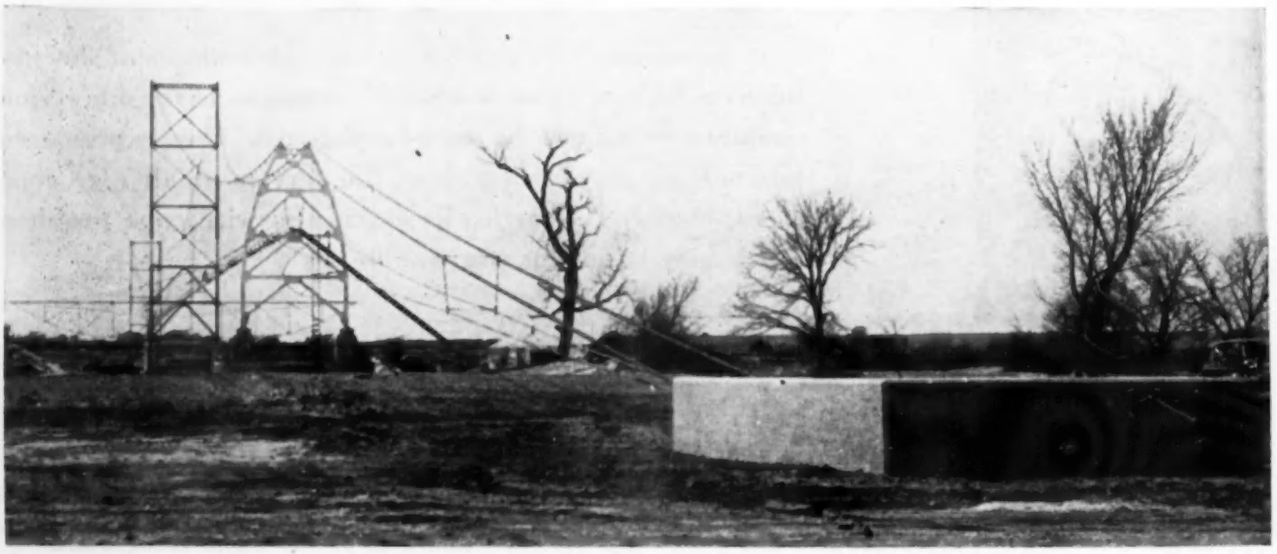
To expedite the pushing of the pipe, a crew made up of both Pittsburgh-Des Moines and Oklahoma Natural men was used. This combination of experience saved several days of time necessary for pushing. The pipe was welded on the platforms in 52-foot joints. As each joint was attached, the entire string of pipe was moved the necessary distance to make room on the platform for the next joint. Movement was accomplished by a hoist, using blocks and lines so rigged that the pipe could be moved either way.

While the pipe is anchored in the ground at each end of the bridge, it is not rigidly attached to the structure at any point.

After all pipe was in place it was hydraulically tested to 988 pounds per square inch. The test served a dual purpose. Besides indicating the safe working pressure for the pipe, the weight of the water doubled the load on the bridge, thereby testing the structure itself.

Because of its proximity to airports, the bridge was painted and lighted according to CAA aircraft warning specifications. The lights are controlled by a photoelectric cell, which turns them on or off according to the degree of darkness.

Coincident with the construction of the bridge across the South Canadian River, the Pittsburgh-Des Moines Steel Company also built a shorter, 360-foot span, pipe-line-suspension bridge across the North Canadian River near Harrah, Oklahoma. It, too, was designed by Kenan. Construction procedure and methods were much the same for both bridges. However, design differed inasmuch as the North Canadian bridge has only one main cable. Both bridges have the same wind-cable system.



View of main span and back span, back span in foreground.

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PRACTICAL OPERATING *Hints* FOR THE PRODUCTION MAN

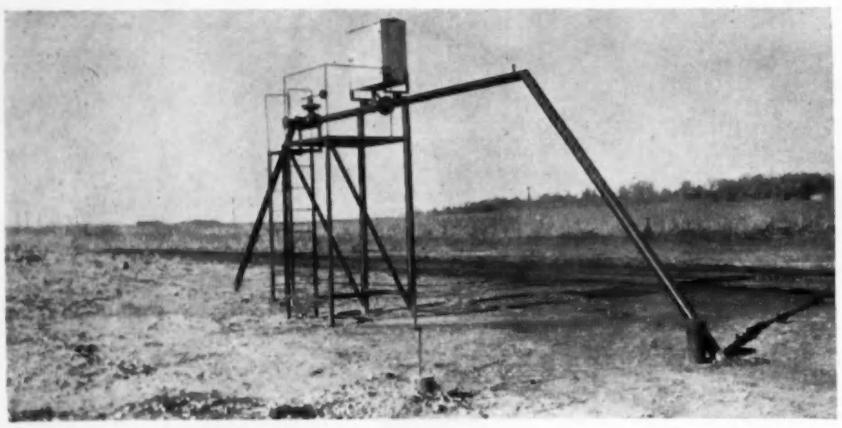
$5.00 will be paid for each illustrated acceptable contribution. Mail to The Editor, THE OIL WEEKLY, *Houston.*

1. METER SETTING

Elevated Run Guards Against Flood Harm

IN THE Cumberland field, which will be submerged by the Dennison flood control project, the recorder meter settings are carried atop unusually high runs, with a boat landing platform which will eventually provide access to individual unit. Pending the inundation of the lowlands, a ladder aids the gauger make necessary chart changes.

Such an installation in river bottoms, with provision for fending floating logs from the elevated structure, permits well flow without time lost for high water. Steel coated with usual pipe enamel is adequately protected against possible corrosion when thus exposed to fresh water.



Platform and ladder permit access to high setting, while submergence of all but run and mount will enable chart snatcher to make rounds with boat without impairing production.

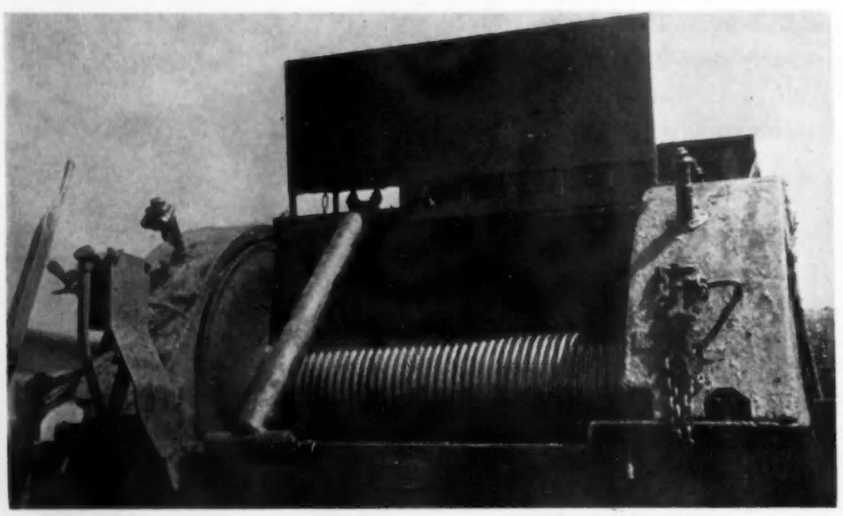
2. WIRE LINE CARE

Separator Bar Saves Unused End of Rope

TO PREVENT drum crushing of the unused portion of the pulling unit line, a bar is hinged to the front of the servicing rig so as to set apart a small portion of the reel. The unused portion of the line is stored behind this bar, the device serving to turn back the line and concentrate wear on only the section in the clear.

To take new line into service, the bar is swung forward on its hinge and the desired amount reeled off, after which the bar is replaced to maintain normal spooling.

The slots in the guard permit a bar to be used at any point across the reel so as to control spooling and prevent possible piling up of the line and consequent premature wear.

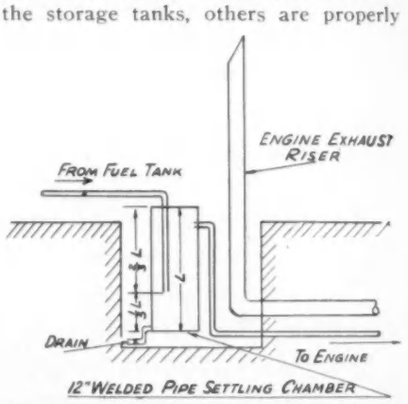


Reeling unused end of service line behind bar permits any desired amount to be added to working line by clearing retainer and unwinding slack as other end is shortened to maintain string-up.

3. FUEL HANDLING

Exhaust Heater Fits Oil for Diesel Use

OPERATION in fields where gas is not available for engine fuel is often handicapped by injection-nozzle trouble resulting from combustion of fuel oil. Many fuel oils are but slightly more refined than crude; some are crude from the storage tanks, others are properly processed. Where the unprocessed oils are used, combustion in the engine cylinder usually causes nozzle corrosion or other trouble.



Diagrammatic sketch of heater, pit, and adjacent exhaust header, enabling fuel to be preheated.

In order to reduce as much as possible the difficulties of using crude oil for engine fuel, a very efficient treating arrangement, involving a short piece of used pipe for a settling tank and the waste heat from the exhaust riser, has been devised by an operator in the Mexia field.

The settling tank, which is fabricated by welding end plates to a section of

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HERE'S the simplest, fastest acting device yet developed for joining together cartridges of gelatin dynamite. It's the "Fast-Coupler"—a new development by Du Pont.

Making up a charge with the "Fast-Coupler" is an easy, one-man operation—requiring but a fraction of the time of any other method.

Along with speed and ease of operation, this new "Coupler" gives the firmest grip on the cartridge yet devised. Charges remain intact under the most adverse conditions of lowering or poling—reducing to a minimum the possibility of loss of a part-charge or a complete load.

Under any conditions of operation the "Fast-Coupler" would be an asset in the field. Today, with manpower short and speed of operation a "must"—no crew chief should fail to investigate this new development.

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See the "Fast-Coupler" demonstrated at the Petroleum Geologists Show, Fort Worth, Texas, April 7-9. Du Pont Booths 8 and 9.

A NEW BOOKLET . . . that completely describes the "Fast-Coupler," is just off the press. Photos of field operations are included. Send for your copy today.

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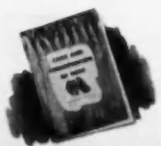

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casing, has inlet and outlet connections for the fuel oil—also a drain connection in the bottom. The oil is chemically treated en route from storage tank to settling chamber; the processed oil is drawn off from the top of the chamber. Success of the process lies in the heating arrangement. Utilizing the heat-insulation properties of the ground, the settling tank is placed in a prepared hole next to the base of the exhaust riser. A very compact heating chamber is formed by placing a cover over the hole; the fuel oil is maintained at a constant, adequate temperature for treating and flowing processes.

4. INSTRUMENT HOUSING

Slip-Over Shield for Recording Meter Unit

A COVER which adequately protects the orifice meter instrument in the field can be made in the shape of a square box with one end open. The front of the cover is fitted with a drawer pull, heavy enough to support the weight of the cover while being removed to change charts and wind the clock.

Below the pull is a diagonal slot opposite the static and differential pens so that inspection of the chart can be made without removing the cover or opening the door of the meter. Slots are made in the cover to permit placing in position over the piping, so that the cover rests solidly on the top of the meter itself.

Formed to enclose meter, traps and bracket, slotted front permits checking without uncovering.

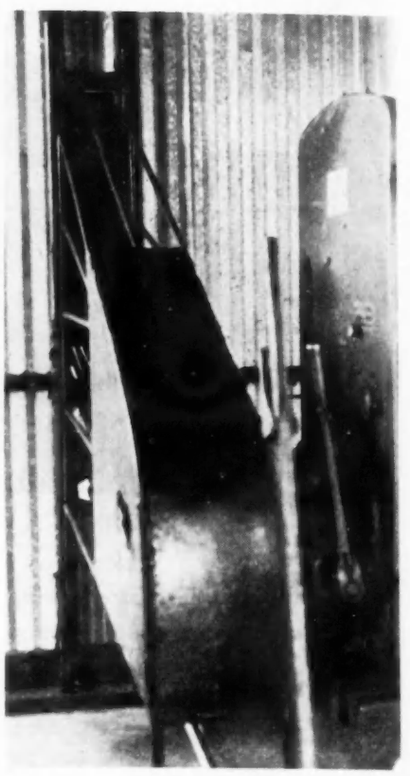
5. SAFETY

Ventilating Guard for V-Belt Pump Drive

WHEN a small weather-proof building is built to cover the gas engine operating a pumping unit which requires that the engine be placed further from the gear case than when operating in the open, an extension of or supplement to the regular belt protector is required.

In this engine building, a home-made protector is installed which is made of junk sucker rods and flat steel.

Built as a tailored protector, the guard fits closely to the opening in the



Solidly welded guard covers pulley, while bar construction admits ample air to provide belt cooling.

side of the building through which the V-belts pass, standing on pads attached to the lower ends of the supporting risers. Clamped at the top, the guard is substantial enough to prevent an employe from being caught in the belts, but it can be moved easily and quickly when necessary to replace or inspect the drive belts.

Only the end of the guard around the sheave is made of sheet metal, the sucker rod skeleton preventing accidental contact with the run of the belts, while at the same time permitting the flow of air to the belts required to forestall overheating and premature failure of the drive.

☆ ☆ ☆ ☆ WASHINGTON ROUNDUP ☆ ☆ ☆ ☆

PAW Issues Order 11 to Supplant Former M-68 Order

⌄

WPB Issues Revised Maintenance and Repair Order P-98-b

⌄

PAW Fears Loss of 85 Percent of 18-38-Year-Old Oil Workers

⌄

WPB Approves Building 20-inch Line All Way to East Coast

⌄

By B. F. LINZ
Washington Correspondent

☆ ☆ ☆ ☆

REISSUANCE of WPB's M-68 as an Petroleum Administrative Order known as PAO-11 to control production operations, and revisions in WPB's P-98-B setting up the procedure for procuring repair, maintenance and operating supplies were the outstanding oil developments in Washington war agencies last Week. Several supplemental orders to PAO-11 also were issued.

These, however, were not the only orders which poured out of the government mill, for PAW issued orders subdividing District 2 into marketing zones and setting up a pool of crude for the relief of small refiners unable to secure supplies in the same district, after they had been carefully reviewed by the Department of Justice, while WPB and OPA also released regulations, chiefly of a clarifying nature, and the latter also corrected its price-increase order on California heavy crude so as to make the advance applicable to sellers along the line.

Concerned over the possibility that the industry may lose as much as 85 percent of its workers to the army and competing war industries within a year, PAW moved to set up the machinery under which district committees will attempt to cope with manpower problems as they arise.

Construction of the projected 20-inch products line right through to the East Coast was approved April 2 by the requirements committee of the War Production Board, as PAW announced that contracts for construction of the first leg to Seymour, Indiana, had been awarded. WPB's quick action on Ickes request for approval of the second leg of the "little big inch" from Seymour east was seen in Washington as demonstrating a determination on the part of the administration to spare no effort to raise deliveries as quickly as possible, partly in recognition of the East's need for additional facilities but more particularly in anticipation of a rapid acceleration of military activities and, consequently, requirements.

PAW is expected to swing into action immediately and to attempt to build the second leg of the line simultaneously with the first section so as to insure its being brought into operation at capacity by the end of the year.

A threatened food shortage also had its repercussions in the shape of a decision to slash by more than 50 percent the acreage which it was planned to sow with guayule this year, but Rubber Director Jeffers held that his synthetic program would be adequate to meet the situation, particularly as no extensive rubber production could be expected from guayule before 1945, and disclosed that problems of quality have been solved and synthetic rubber now is suitable for all purposes without admixture with natural crude.

Revised M-68 Order Designed to Simplify Administrative Procedure

Retitled Petroleum Administrative Order No. 11, WPB's M-68, dealing with production operations, was reissued March 30 by PAW, whose officials declared it a "major step" in the simplification of administrative procedure. (THE OIL WEEKLY, March 22.)

Under the new order, it was said, the producers will find "more flexibility, simplification and clarification than in the old order, as result of the experience we have gained during the past year."

The major changes in the order were outlined by PAW, as follows:

1. "Maintenance or repair" is redefined to exclude any restriction because of accounting practices and to include capital additions not exceeding $500 in material costs.

2. Pumping equipment may not be installed at flowing wells prior to the time such wells cease to flow naturally, except where the wells are no longer capable of flowing their allowables.

3. "Condensate field" is no longer defined; instead, 115 fields are specifically listed as condensate fields in which an exception is required before any drilling can be done, the list to be modified from time to time as need requires.

4. "Exploratory well" has been modified to exclude any well in the proven area of a gas or condensate field, regardless of distance from other wells.

5. The order permits the plugging back or deepening of oil wells whose locations conform to the 40-acre drilling pattern established under the order, even though those wells are not the only wells on the units and are not the prescribed distance from offset wells.

6. Gathering systems may be constructed to connect wells to a pipe line provided the material costs do not exceed $2500 and provided the new installation does not duplicate an existing facility.

7. Except as provided in Supplementary Order No. 1, the drilling of all gas wells requires exceptions.

8. The new order supersedes Supplementary Order No. 5 to the old M-68, relating to Illinois, and also Petroleum Administrative Order No. 6, relating to Hugoton gas field, which have been revoked.

9. In sectionalized areas, the drilling unit is redefined so that it must consist of a quarter-quarter section of at least 35 acres.

Secondary Recovery

10. Secondary-recovery operations, regardless of geographic location, are no longer automatically excepted. Supplementary Order No. 2 accompanying PAW Order No. 11 provides automatic approval for secondary-recovery operations in the Eastern fields. In other areas lack of concurrence within the industry as to the definition of "secondary-recovery operations" necessitated deletion of the automatic exemptions, and an exception is hereafter required before installing secondary-recovery facilities in all areas outside of the Eastern fields.

11. PAW forms 3 and 4 will be used in connection with the new order, instead of OPC Forms PD-214-a, b and c, thereby reducing the number of forms now in use.

With the order, PAW put out supplementary order No. 1, prescribing the conditions under which gas wells may be drilled in the Appalachian area and in a specified area in Oklahoma, Kansas and Missouri without securing special authorization; Supplementary Order No. 2, providing automatic authority to carry out secondary-recovery operations in the Eastern fields and providing specific well-spacing requirements for drilling in areas where secondary-recovery operations are not carried on; and Supplementary Order No. 3, providing for the reworking of old wells in the Smackover (Arkansas) field.

The special problems of the California industry are under consideration and an announcement in relation thereto will be made in the very near future, it was said. In the meantime, Supplementary Order M-68-3 relating to heavy-oil operations in California has been reissued as Supplementary Order No. 4 to PAO No. 11 and will continue in force until superseded by an order incorporating a wider range of production operations.

PAW also reissued as Supplementary Order No. 5 the M-68-5 order granting

Full text of new PAO-11 (formerly M-68) appears on page 102, with following pages carrying information on data required to obtain exceptions, and also Supplementary Orders Nos. 1, 2, 3, and 4.

an exception to the Illinois Basin, under which, in Illinois and parts of Indiana and Kentucky, wells in sandstone formations could be drilled to 2500 feet on a pattern of one well to ten acres and to deeper depths on a pattern of one well to 20 acres.

Less Paper Work

Commenting on the order, Deputy Administrator Davies said: "The intent of the new order is to outline certain general conditions under which authority to acquire and use materials is automatically granted for use in production operations, thereby reducing paper work to a minimum. Supplementary orders are issued to fit the operating conditions in certain fields or areas, permitting use of materials under less restrictive conditions than are prescribed in the general order. Provision is also made for granting special exceptions where special conditions warrant such action. Exceptions which have been granted under the old order are not disturbed and applications pending under the old order will be treated as applications under the new order. We cannot allocate or regulate the use of materials without some paper work, but we want to eliminate it as far as humanly possible.

"The new order imposes no restrictions on the use of material for wildcat wells. This is in keeping with our policy of encouraging a maximum amount of exploratory work to discover new reserves."

Oil Operators Exempt From Inventory Provisions

Petroleum operators have been exempted from the inventory provisions of the WPB Controlled Materials Plan regulations and will operate under the provisions of the new recently-announced P-98-c. (Page 34, THE OIL WEEKLY, March 29, 1943.)

Also exempted from the CMP were mine operators and utilities, including natural-gas suppliers who will continue to be governed by the inventory provisions of Utilities Order U-1.

It was explained by WPB officials that oil operators and the other groups exempted do not have problems of inventories of materials which actually go into production but, rather, carry inventories chiefly for repair, maintenance and operation. As a result, it was said, their problems are different from those generally encountered in manufacturing industry and, as such, require the special treatment which will be accorded under the specific orders applying to each.

Amended P-98-b Order Clarifies Use of Materials Under New CMP Regulation

Amending Preference Rating Order P-98-b to conform to the Controlled Materials Plan under which the maintenance, repair and operating material needs of most industries hereafter will be regulated, WPB reissued the order in permanent form April 1.

The order will cover all operators' requirements for supplies for use in the United States and Canada and a preference rating of AA-1 and an allotment symbol MRO-P-98-b have been authorized.

Under the order, when the cost of any single item is $500 or more or when the total cost of all items is $1000 or more but no single item amounts to $500, prior submission of the delivery order to the Washington PAW office or Canadian Oil Controller for approval will be required. When the total cost of all items is more than $100 but less than $1000 and no single item is as high as $500, a copy of the delivery order, for information only, must be submitted to the PAW District Office or Canadian Oil Controller, but no approval is required.

Emergencies involving actual breakdown or suspension of operations may be handled by telephone, telegram or letter to PAW Washington office.

An operator who has complied with the above conditions may place a delivery order and use the allotment number or preference rating authorized, under the following procedure:

1. Place the delivery order with the supplier and show the authorized allotment symbol and preference rating thereon.

2. Place the delivery order for controlled materials, other than aluminum, as an authorized order, provided that the operator certifies his right to receive the same in the prescribed form and provided the delivery order is in sufficient detail to permit entry on mill schedules. Such orders must be received by the controlled materials producers at such time in advance as is specified in schedule of CMP Regulation No. 1. Unless a controlled materials producer, without discriminating among customers, shall accept a late order.

3. Any delivery order rated, authorized and certified under P-98-b shall have the allotment symbol P-98-b and shall have the same status as an order bearing an allotment symbol and preference rating under CMP Regulation No. 3.

4. An operator requiring aluminum for maintenance, repair and operating supplies, may obtain, from all sources, a total not to exceed 100 pounds per calendar quarter.

He may obtain the metal from a controlled materials producer or an approved aluminum warehouse by endorsing the delivery order with the special form of certification provided for such cases.

The order prohibits operators from using allotment numbers or preference ratings for the following purposes:

To obtain deliveries of materials on earlier dates or in greater amounts than required to fulfill the purposes for which it was authorized.

To obtain deliveries of materials which can be secured without the use of an allotment number or preference rating.

To obtain deliveries of materials for any purpose other than the one authorized by the order.

To obtain deliveries of materials, the use of which could be eliminated without serious loss of efficiency, by change of design or substitution of less scarce material.

To obtain deliveries of materials which would result in accumulation of more than 90 days' supply.

Unless they are participants (if required by its terms) in PAW Materials Redistribution Program No. 2, or

To obtain deliveries of material in violation of any applicable order or regulation of PAW or WPB.

Accompanying the order were two schedules defining the types of materials which can or cannot be classified as maintenance, repair and operating supplies.

PAW Warns Industry Manpower Problem Will Get Progressively More Acute

Foreseeing the loss within the next year of possibly as many as 85 percent of oil-industry workers between the ages of 18 and 38 to the Army and the defection of others who switch over to other war industries actively competing for labor, Deputy Administrator Davies last week warned that an "acute" manpower problem is in the making.

In a letter to the chairmen of the district general committees, Davies laid down programs to be followed by them and by the several district division directors, by which it is hoped that labor problems can be dealt with effectively as they arise.

Responsibilities of the district functional committees will be to:

Assist in the determination of manpower requirements and advise the division directors concerning the probable effects of manpower deficiencies on the scheduled programs in the various fields of industry operations;

Inform the division directors in Washington as to specific manpower problems which are impeding or threatening to interfere with the respective programs of the industry;

As called upon by PAW, make recommendations concerning labor priorities and the allocation of manpower to various facilities; and

Establish avenues for the distribution and exchange of information concerning programs for deferment of key personnel, replacement of men inducted into the armed forces, efficient utilization of workers, and other manpower problems.

Each district division director, Davies instructed, shall:

Report promptly to the division director specific manpower problems or deficiencies which are impeding or threatening to interfere with the output and programs of operation of the industry which cannot be solved locally;

Answer inquiries and inform employers concerning certain manpower matters (es-

sential activities, deferments, manning tables and replacement schedules, etc.), in accordance with general instructions to be issued by PAW division directors and the "Manpower Manual";

Make representation on behalf of PAW to regional and local officers of the War Manpower Commission, the Selective Service System and the War Labor Board in accordance with specific instructions of the division directors; and

Assist and work closely with district industry committees in connection with their manpower functions as outlined.

In his letter, Davies pointed out that each management must solve its own particular manpower problems, but there are many situations where exchange of information and ideas will enable employers to do the job better, and there are other matters which require coordinated planning and united action on the part of the several branches of the industry.

In the near future, he disclosed, lists of specific problems and a manpower manual on the subject will be distributed and the recently appointed labor counselor, Frederick H. Harbison, will be available to meet with district committees and to give them assistance as necessary and also plans to visit the various district offices from time to time to discuss problems with which they may be dealing.

Guayule Acreage Cut as Rubber Plants Progress

The government's ambitious guayule-rubber program will be streamlined by several thousand acres from the fat 53,000 acres it was proposed to plant, as a result of manpower and land shortages.

Just how heavily the projected acreage will be cut has not been decided, but officials say it will be considerable. It is explained that the synthetic-rubber program is moving along and that the food problem is more acute than that in rubber. There is just so much labor and just so much irrigated land available, it is pointed out, and the decision has been made to devote maximum effort to food production.

The guayule project was just one of a number of schemes to produce rubber from American shrubs and vines. All of them would require tremendous acreages and a great deal of manpower to provide even a fraction of the rubber consumed in this country, and it was admitted that probably none of them could compete with natural tree rubber in normal times.

Other rubber projects include the tapping of chilte (Sinoloa gum) trees in Mexico and the cultivation of cryptostegia, a quick-growing vine, in Haiti.

Chilte rubber, produced only in western Mexico, was used during and immediately following the last war, and is being considered now because it has a high resin content and is considered particularly adaptable for mixture with synthetic rubber. Mexico also produces guayule rubber.

Reports also are circulating that the synthetic-rubber-plant construction program is moving along better than expected, and may bring about a renewed tug-of-war over allocations of critical materials to that use or to construction of naval escort vessels.

Should investigation show that the synthetic plants actually are equal to or ahead of schedule, the Navy may be expected to ask WPB again to give it a greater percentage of the available supplies, in which case Rubber Director Jeffers is expected to be no less adamant than he was two months ago, when he won his fight for enough materials to make a respectable proportion of the Baruch-recommended rubber program possible.

Crude "Kitty" to Aid Refiners in District 2

Two PAW directives, 64 and 65, have been issued to deal with District 2 problems, the first setting up a crude "kitty" for refiners lacking sources of supply and the other establishing a zoning system to reduce transportation mileage.

The "kitty" order calls for the setting aside of 40,500 barrels of crude daily from District 2 production, or approximately four percent of the output, for allocation to refineries designated by PAW on the basis of their capacity for producing war products, the supply of crude available from other sources and efficient use of transportation facilities. All companies in the district running 2000 barrels per day or more in December will be called upon to make contributions to the pool, which is designed to protect efficient small refineries from being forced to close down for lack of supply.

The zoning order, cutting the district up into small areas, is aimed at coordinating the supply and distribution of the approximately 1,000,000 barrels daily of products consumed in the Midwest.

Zones are based on the relative location of refineries, pipe lines, water terminals and other factors of supply and transportation facilities. All suppliers may accept orders as usual but will be required, by pooling, exchanges, etc., to fill them from the terminal supply point nearest the purchaser.

The purpose of the order is to minimize distances any product is transported; eliminate most movements in a general southerly and westerly direction and substitute movements in a general northerly or easterly direction; eliminate back-hauling and cross-hauling; substitute in many cases pipe line transportation for tank car, trucks, barge or lake tanker, and release mobile transportation equipment for use in supplying the East Coast.

Oil Moving Through Plantation Extension

First oil to run through the Plantation Pipe Line extension from Greensboro, N. C., to Richmond, Va., started moving April 2, and is expected to arrive at its destination in about ten days. Initial deliveries will be about 15,000 barrels daily, which are expected to double during the month as the pumping stations not yet completed are brought into operation.

Products Line Contracts Let in Nine Sections

Contracts for construction of the $44,000,000 Texas-Indiana section of the 20-inch products line have been awarded and construction is expected to get under way before the middle of the month.

Sixteen survey parties are staking the route between Texas and the point where the line will cut into the big-inch right-of-way, and the first shipment of pipe is expected to leave the steel mill this week.

The main line has been split into nine spreads, which will be built simultaneously. William Brothers Corporation has the contract for the feeder lines in the Beaumont-Houston area and also for one of the main-line sections, the others of which will be built by Sharman and Allen, N. A. Saigh Company, Winston-Guthrie-Brown, B & M Construction Company, Oil States Construction Company, Swinerton & Walberg Company, Midwestern Engineering & Construction Company, and J. C. Truman.

Construction Progress On Big Line Satisfactory

Despite late snow and spring mud, construction crews on the big-inch pipe line already have laid approximately one fourth of the conduit required to traverse the 809-mile stretch between Norris City, Illinois, and the New York-Philadelphia refineries, it is reported by Administrator Ickes.

Actual pipe-laying is now in progress on all of the 17 sections on the eastern leg, Ickes said, adding that with an "even break" on the weather construction will be completed on schedule.

Initial operations were hampered by heavy rainfall over the entire route of the line, with numerous rivers, as well as smaller streams, at flood stage.

A straightening of the route through the procurement of more favorable rights-of-way has cut the actual mileage of the line from 1385 to 1340 miles.

Senate Will Again Investigate Pipe Line

The appetite for Congressional investigations of oil matters continues unsated, Senator Burnet R. Maybank of South Carolina adding to the list of proposed probes March 30 with a resolution for an inquiry by the Senate oil committee into the trans-America pipe line from the Tinsley oil field to Charleston, South Carolina, or Savannah, Georgia, with a view to determining why construction, which was authorized in legislation approved July 23, 1942, has not been undertaken.

Florida Barge Canal Funds Denied by House Committee

Rejecting a subcommittee recommendation that the Florida barge canal be immediately constructed, the House Appropriations Committee refused March 31 to include the $44,000,000 necessary, in the War Department civil function supply bill.

Although the subcommittee had given the project a strong recommendation, the full committee held that it could not do much to ease the situation in the Eastern states "for many months to come" and that pipe lines already built or under construction, together with rail and water transportation, "will take care of the Eastern Seaboard area during the next winter in a normal way."

The House passed the bill April 1 without making any effort to restore the canal item, but another and final effort to secure the money for its construction is expected to be made in the Senate.

TITLE 32—NATIONAL DEFENSE
CHAPTER XIII—PETROLEUM ADMINISTRATION FOR WAR
PART 1515—PETROLEUM PRODUCTION OPERATIONS

Petroleum Administrative Order No. 11

The fulfillment of the requirements for the defense of the United States has created a shortage of materials necessary for the production of petroleum for defense, for private account, and for export; and the following order is deemed necessary in the public interest, to promote the national defense, and to provide adequate supplies of petroleum for military and other essential purposes.

Pursuant to Conservation Order M-68 as amended January 4, 1943, (Section 1047.1), section 1047.1 (Conservation Order M-68) is renumbered section 1515.6 of this chapter and amended to read as follows:

Section 1515.6 Petroleum Administrative Order No. 11.

(a) **Scope of this Order.**

Except as otherwise modified by the provisions of any Order issued as a supplement to this Order, the provisions of this Order shall be applicable to petroleum production operations in the United States, its territories or possessions, but not elsewhere, and to the delivery, acquisition, or use of material for such operations.

(b) **Definitions.**

(1) "Person" means any individual, partnership, association, business trust, corporation, governmental corporation or agency, or any organized group of persons, whether incorporated or not.

(2) "Material" means any commodity, equipment, accessory, part, assembly, or product of any kind.

(3) "Petroleum" means petroleum, petroleum products, and associated hydrocarbons, including but not limited to natural gas, except that natural gas which has entered into gas transmission lines from field gathering lines shall not be so included.

(4) "Production" means any operation directly incident to:
  (i) the discovery, development, or depletion of petroleum pools; or
  (ii) the extraction or recovery of natural gasoline and associated hydrocarbons.

(5) "Production Operation" means any use of material for construction, expansion, improvement, reconstruction, remodeling, alteration, maintenance, repair, or replacement incident to production.

(6) "Maintenance or Repair" means (without regard to accounting practice) any use of material in production consisting of any of the following:
  (i) the upkeep of material or equipment in a sound working condition; or
  (ii) the restoration of material or equipment which has been rendered unsafe or unfit for service by wear and tear, damage, destruction, failure of parts or similar causes; or
  (iii) a capital addition (excluding the installation or replacement of pumping or other artificial lifting equipment and the deepening or plugging back of any well) not exceeding in material cost $500 for any one complete operation which has not been subdivided for the purpose of coming within this definition.

Provided, that upkeep or restoration shall not include any use of material for the improvement of material or equipment by the replacement of material which is still serviceable in the existing material or equipment.

(7) "Exploratory Well" means any well located at least two miles from every drilling or producible well: *Provided,* that exploratory well shall not include any well located in any field or area which at the time of the drilling of such well has been "proven" to be productive only of gas or condensate, or both, by the drilling of wells other than such well.

(8) "Pool" means any underground accumulation of crude petroleum or associated hydrocarbon substances, including but not limited to natural gas, constituting a single and separate reservoir or source of supply within a field, area or horizon, whether or not presently discovered or developed.

(9) "Lease Equipment" means fixed or stationary equipment or material for direct or indirect use in production installed on any property located within the productive boundaries of any field including but not limited to oil treating equipment, salt water disposal or injection equipment, fresh water wells and the equipment therefor or production office or camp facilities located adjacent to any field: *Provided,* that lease equipment shall not include: an oil, gas, or condensate well; well equipment, pumping or artificial lifting facilities, or flow, lead, and gathering lines for such well; cycling plants; pressure maintenance plants; secondary recovery plants; or plants for the extraction or recovery of natural gasoline and associated hydrocarbons or for other treatment or processing of gas.

(10) "Property Interest" means any interest of an oil or gas lessee: *Provided,* that where no oil or gas lease exists on any parcel of land, the property interest in such land shall be deemed to be the aggregate of the interests in such land covering the right to drill for and produce petroleum.

(11) "Condensate Field" means any field or pool designated as such by Exhibit "A" of this Order, as amended from time to time.

(c) **Restrictions on Acquisition and Use of Material.**

Subject to the provisions of paragraph (f) of this Order, no person shall accept delivery of, acquire, or use material for a production operation except where:

(1) such material is to be used for maintenance or repair.

(2) such material is to be used exclusively for operations directly involved in the search for and discovery of a previously unknown pool by means of geological, geophysical, or geochemical prospecting, or the drilling or completion of any exploratory well.

(3) such material is to be used to complete any well actually being drilled on March 31, 1943, in conformity with any previously issued Conservation Order M-68 (Section 1047.1), or supplementary order thereto.

(4) such material is to be used to construct, install, or extend a crude oil gathering line from the first valve on the discharge side of the lease or field shipping tank or battery where petroleum is first gauged to any transportation facility or such material is to be used to construct, install, or extend a field gathering line for the transmission of gas from the well-head connection to the point at which such gas leaves the gathering line: *Provided,* that material shall not be used to construct, install, or extend any such gathering line,
  (i) which duplicates in whole or in part the transportation functions of any existing gathering line or gathering lines; or
  (ii) which has a material cost when completed of more than $2,500.

(5) such material is to be used for pumping or other artificial lifting equipment to be installed on a well located on any lease or tract on which the number of wells to which pumping or other artificial lifting equipment is attached does not at any time exceed an average of one well to every ten surface acres of the part or parts of such lease or tract which are contained within the productive limits of the field; or such material is to be used for pumping or other artificial lifting equipment to be installed on a well located on any lease or tract of ten acres or less on which no other well is located to which pumping or other artificial lifting equipment is attached and which lease or tract has not been subdivided or re-

arranged for the purpose of making the provisions hereof available.

(6) such material is to be used to drill, complete, equip, connect, or provide additions to any oil well in any discovered oil field (other than a condensate field) in which the surface is divided into quarter - quarter sections (north, south, east or west quarter-quarters), on a quarter-quarter section of at least 35 surface acres in conformity with a uniform well-spacing pattern, as defined by paragraph (d)(1) of this Order, of not more than one single drilling or producible well to each such quarter-quarter section.

(7) such material is to be used to drill, complete, equip, connect, or provide additions to any oil well in any discovered oil field (other than a condensate field) in which the surface is not divided into quarter-quarter sections, in conformity with a uniform well-spacing pattern as defined by paragraph (d)(2) of this Order, of not more than one single drilling or producible well to each 40 surface acres.

(8) such material is to be used for lease equipment.

(9) such material is to be used to plug-back and recomplete any oil well which conforms to all of the provisions of paragraph (c)(6) or (c)(7), whichever is applicable, except the provisions requiring that such well be the only well located upon the drilling unit and that such well be located at least 990 feet from every other drilling or producible well: *Provided,* that such well is not recompleted as a gas or condensate well.

(10) such material is to be used in conformity with an exception issued under Conservation Order M-68 in response to an application in accordance with any OPC Form PD-214, an Order issued as a supplement to this Order, or an authorization of the Petroleum Administration for War issued in response to an application filed in accordance with paragraph (g) of this Order.

(d) **Determination of Uniform Well-Spacing Pattern.**

(1) **Quarter-Quarter Section Drilling Units.**

Each oil well located on a drilling unit consisting of a quarter-quarter section of at least 35 surface acres, pursuant to paragraph (c)(6) of this Order, shall be drilled in accordance with a uniform well - spacing pattern, only where:

(i) such well bears the same geographical relationship to the quarter - quarter section on which it is drilled as the first well spudded in the same field subsequent to December 23, 1941, on an approximately square drilling unit (consisting of at least 40 surface acres or a quarter-quarter section of at least 35 surface acres), bears to the drilling unit upon which it is located: *Provided,* that any well located within 100 feet of the point at which an identical geographical relationship would be attained or within 150 feet of the center of a quarter-quarter section shall, subject to paragraphs (d)(1)(iii) to (d)(1)(vii), inclusive, be deemed to conform to a uniform well-spacing pattern; or

(ii) such well conforms only to paragraphs (d)(1)(iii) to (d)(1)(vii), inclusive, if it is the first well spudded in the field subsequent to December 23, 1941, on an approximately square drilling unit (consisting of at least 40 surface acres or a quarter-quarter section of at least 35 surface acres); and

(iii) all separate property interests in the quarter-quarter section upon which such well is drilled are first consolidated with each other; and

(iv) such well is the only drilling or producible well located on the quarter-quarter section; and

(v) such well is drilled at least 990 feet from every other drilling or producible well; and

(vi) such well is drilled at least 330 feet from every lease line, property line, or subdivision line which separates unconsolidated property interests and from every border of the quarter-quarter section upon which such well is located; and

(vii) such well is drilled with due diligence to maintain a vertical well-bore.

(2) **Drilling Units Other Than Quarter-Quarter Sections.**

Each oil well located on a drilling unit consisting of not less than 40 surface acres, pursuant to paragraph (c)(7) of this Order, shall be drilled in accordance with a uniform well-spacing pattern, only where:

(i) the drilling unit upon which such well is drilled consists entirely of acreage which is not attributable to any other oil well located within the same lease or property; and

(ii) all separate property interests in the drilling unit upon which such well is drilled are first consolidated with each other; and

(iii) the direct linear distance between any two points which are farthest removed from each other on the drilling unit upon which such well is drilled does not exceed the length of the diagonal of a rectangle, the length of which is twice its width and which is equivalent in surface acreage to such drilling unit; and

(iv) no portion of the drilling unit attributed to such well falls within 330 feet of any other drilling or producible well located within the same lease or property; and

(v) such well is drilled at least 990 feet from every other drilling or producible well; and

(vi) such well is drilled at least 330 feet from every lease line, property line, or subdivision line which separates unconsolidated property interests; and

(vii) such well is drilled with due diligence to maintain a vertical well-bore.

(e) **Computation of Attributable Acreage.**

(1) The acreage attributable to any well spudded on or before December 23, 1941, shall be determined by assigning to such well an acreage equivalent to that in the existing well density or drilling pattern contiguous to such well.

(2) The acreage attributable to any well spudded subsequent to December 23, 1941, shall be the same as the drilling unit assigned to such well pursuant to Conservation Order M-68, any Supplementary M-68 Order, any exception issued pursuant to a determination under Conservation Order M-68, or pursuant to this Order, any Order issued as a supplement to this Order, or any authorization issued in response to an application filed in accordance with paragraph (g) of this Order, whichever is applicable.

(f) **Restrictions on Installation of Pumping or Other Artificial Lifting Equipment.**

Notwithstanding the provisions of paragraphs (c)(5), (c)(6), (c)(7) and (c)(9), no person shall install pumping or other artificial lifting equipment upon any well prior to the time at which such well ceases to flow naturally or upon any well which will not be produced immediately after the installation of such pumping or other artificial lifting equipment and continuously thereafter to the extent permitted by law: *Provided,* that the provisions of this paragraph shall not apply to the installation of pumping or other artificial lifting equipment upon any well which has ceased to flow naturally at a rate at least equal to its "allowable production."

(g) **Application for Exceptions Pursuant to Paragraph (c)(10).**

(1) Applications for exception (authorization to accept delivery of, acquire, or use material for a production operation which does not conform to the provisions of paragraphs (c)(1) to (c)(9), inclusive) shall be made under paragraph (c)(10) of this Order in quadruplicate by letter and shall contain:

(i) the information specified in PAW Form 3 for any operation directly incident to the discovery, development or depletion of petroleum pools.

(ii) the information specified in PAW Form 4 for any operation incident to the extraction or recovery of natural

gasoline or associated hydrocarbons.

(2) Information required for an authorization to accept delivery of, acquire, or use material shall be addressed to:

(i) the Director of Production where a crude oil operation, including pressure maintenance, repressuring, and secondary recovery operations, or

(ii) the Director of Natural Gas and Natural Gasoline where a natural gas, natural gasoline, or condensate operation.

Such information shall, unless otherwise directed, be submitted to the Petroleum Administration for War, Interior Building, Washington, D.C., Ref: PAO 11.

(h) **Revocation of Supplementary M-68 Orders.**

Supplementary Order No. M-68-1 (Section 1047.6), Supplementary Order No. M-68-2 (Section 1047.7), Supplementary Order No. M-68-4 (Section 1047.9), Supplementary Order No. M-68-6 (Section 1047.11), Petroleum Administrative Order No. 2 (Section 1515.1), and Petroleum Administrative Order No. 6 (Section 1515.2), as such orders may have been amended from time to time are hereby revoked except with respect to wells the actual physical drilling of which was either commenced or concluded pursuant to any such Order on or prior to March 31, 1943, or except with respect to natural gasoline extraction plants the construction, expansion, improvement, reconstruction, remodeling, or alteration of which was either commenced or concluded pursuant to any such Order on or prior to March 31, 1943. This action shall not be construed to relieve any person of the necessity of complying with any such Order as to any well purportedly spudded under such Order on or prior to March 31, 1943, or to affect any liabilities or penalties incurred thereunder, or to affect the status of any administrative process, any prosecution or the application of any penalty in connection with any such liabilities.

(i) **Directions.**

The Petroleum Administration for War may, from time to time, issue directions with respect to the delivery, acquisition, or use of material for production purposes.

(j) **Violations.**

Any person who wilfully violates any provision of this Order, or who, by any act or omission, falsifies records kept or information furnished in connection with this Order is guilty of a crime and upon conviction may be punished by fine or imprisonment.

Any person who wilfully violates any provision of this Order may be prohibited from delivering or receiving any material under priority control, or such other action may be taken as is deemed appropriate.

(k) This Order shall be effective on and after March 31, 1943.

(E.O. 9276, 7 F.R. 10091; E.O. 9125, 7 F.R. 2719; sec. 2(a) Pub. Law 671, 76th Cong., as amended by Pub. Laws 89 and 507, 77th Cong.)

Issued this 30th day of March, 1943.

(SGD.) R. K. DAVIES

Deputy Petroleum Administrator for War.

EXHIBIT "A"
Condensate Fields

The following fields are hereby declared to be condensate fields for the purposes of this Order: *Provided,* that where the name of a field is succeeded by the names of one or more pools or geological formations in parenthesis only the pools or formations so designated shall be deemed to be a condensate field:

East Central Texas

Field	County
Barron	Limestone
Bethany	Panola
Carthage	Panola
Cayuga	Anderson, Henderson, Freestone
Chapel Hill	Smith
Grapeland	Houston
Hawkins (Sub-Clarksville)	Wood
Long Lake	Anderson, Freestone, Leon
Opelika	Henderson
Rodessa (Hill Sand)	Cass and Marion
Tri-Cities	Henderson
Willow Springs	Gregg

Texas Upper Gulf Coast

Aldine	Harris
Alief	Harris
Angleton	Brazoria
Bammel	Harris
Blessing	Matagorda
Bucksnag	Colorado
Buttermilk Slough	Matagorda
Chocolate Bayou	Brazoria
Dickinson-Gillock	Galveston
Eureka Heights (Deep)	Harris
Francitas	Jackson
Joyce Richardson	Harris
Hamman	Matagorda
Katy	Waller
Lake Creek	Montgomery
Lissie	Wharton
Needville	Fort Bend
North Houston	Harris
Old Ocean	Brazoria

Texas Upper Gulf Coast—(Cont'd)

Field	County
Orange Hill	Austin
Palacios	Matagorda
Pledger	Brazoria
Port Lavaca	Calhoun
Provident City	Lavaca
Red Fish Reef	Chambers
Rosenberg	Fort Bend
Rosalyn	Harris
Shepherd	San Jacinto
Sheridan	Colorado
South Anahuac	Chambers
Texana	Jackson
Vienna	Lavaca
West Aldine	Harris
Willow Slough	Chambers

South Texas

Agua Dulce	Nueces
Alice	Jim Wells
Banquette	Nueces
Ben Bolt	Jim Wells
Blucher	Jim Wells
North Sweden (Hiawatha sand on east flank of pool, only)	Duval
Nordheim	DeWitt
Quinto Creek	Jim Wells
Carolina-Texas	Webb
Caloma Creek	Calhoun
East Plymouth	San Patricio
La Blanca	Hidalgo
La Gloria	Jim Wells, Brooks
La Rosa	Refugio
La Reforma	Starr
McAllen	Hidalgo
McLean	Webb
Mercedes	Hidalgo
Saint Charles	Aransas
Sandia	Jim Wells
San Salvador	Hidalgo
Sejita	Duval
Shield	Nueces
Sinton	San Patricio
Stratton	Nueces, Jim Wells, Kleberg
Tuleta, West	Bee
Weslaco	Hidalgo
Yorktown	DeWitt

South Louisiana

Abbeville	Vermilion
Bateman Lake	St. Mary
Branch	Acadia

South Louisiana—(Cont'd)

Field	County
Belle Isle	St. Mary
China	Jefferson Davis
Deer Island	Terrebonne
DeLarge	Terrebonne
Delta Farms	La Fourche, Jefferson
Erath	Vermilion
Gibson	Terrebonne
Krotz Springs	St. Landry
La Fourche Crossing	La Fourche
Lake Arthur	Jefferson Davis
Lake Chicot	St. Martin
Lake Long	La Fourche
Lake Mongoulois	St. Martin
Lakeside	Cameron
La Place	St. John the Baptist
Lewisburg	St. Landry
Lirette	Terrebonne
Little Chenière	Cameron
North Elton	Allen
North Tepetate	Acadia
Pecan Island	Vermilion
Pecan Lake	Cameron
Point au Fer	Terrebonne
South Elton	Jefferson Davis
South Jennings	Jefferson Davis
Thornwell	Jefferson Davis
Unknown Pass	Orleans
West Gueydan	Vermilion
West Mermentau	Jefferson Davis

North Louisiana

Athens	Claiborne
Bear Creek	Bienville
Beekman	Morehouse
Calvin	Winn
Cotton Valley	Webster
Lisbon	Claiborne
Rodessa (Hill Sand)	Caddo
Sibley	Webster
Sligo	Bossier
Sugar Creek	Claiborne

Arkansas

Big Creek	Columbia
Dorcheat	Columbia
Macedonia	Columbia
McKamie	Lafayette
Texarkana	Miller

California

Helm	Fresno
Paloma	Kern

PAW Form 3

Information Required to Obtain Exception for the Development of All or Any Portion of Any Oil, Gas, or Condensate Field

☆ ☆ ☆

Bureau of the Budget No. 42-R471
Approval Expires March 31, 1944

Submit three copies of all communications to the Petroleum Administration for War, Washington, D. C., addressed to the Director of Production if a crude oil operation (including pressure maintenance, repressuring, and secondary recovery operations for oil fields, or to the Director of Natural Gas and Natural Gasoline if a natural gas or condensate operation. A fourth copy must be submitted to the District Office, Petroleum Administration for War, for the district in which the property of the applicant is located. Do not use this form for natural gasoline extraction operations—use PAW Form 4.

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To obtain an authorization, as provided by Paragraph (c)(10) of Petroleum Administrative Order No. 11, for the development of all or any part of any oil, gas, or condensate field, it is necessary for the Petroleum Administration for War to determine the relationship of the specific case to the war needs. In order to perform this function, the Petroleum Administration for War must receive from the applicant a statement in quadruplicate containing the following information:

(1) Name and address of applicant.

(2) Location of proposed operations.

(3) Describe proposed operations in sufficient detail for complete identification.

(4) Lease data: Map of lease or properties and offsetting properties, showing ownerships, location of all wells, total depths of all wells, proper designation of types of wells, all proposed locations; outlining the drilling unit attributable to each well; designating all wells drilled after December 23, 1941; and indicating location of pattern-fixing well.

(5) Reservoir data: Name, depth, thickness and character of each producing horizon, estimated future recovery per acre of oil, gas, condensate, estimated recovery from proposed operations, and available subsurface maps and cross-sections.

(6) Operating data: Initial production and present daily production of oil, gas, condensate, and water from each well. Initial bottom hole pressures and present bottom hole pressures.

(For Deepening or Plug-Back Operations, state estimated reserves which will be abandoned.)

(For Installation or Replacement of Pumping or Other Artificial Lifting Equipment, designate by appropriate symbols on map (referred to in (4) above) the type of artificial lifting facilities presently installed on each well.)

(For Secondary Recovery Operations, describe fully, existing operations including type, well spacing pattern for oil wells and injection wells, core analyses, operating capacity of pressure plant and pressure lines, source of gas or water used for injection purposes.)

(7) Gravity of the Oil. (Also note any special qualities.)

(8) Total material requirements, segregated for (a) wells, (b) lease equipment, (c) gathering lines, (d) other plants or facilities. **(For Secondary Recovery Operations,** state these amounts in tons by calendar quarters.)

(9) In addition to the applicable information requested above, submit the following information for operations involving the drilling and connecting of wells in any gas or condensate field:

(a) Transportation and Demand: (i) State and show on map (referred to in (4) above) what transportation facilities are available and gathering lines proposed; (ii) State capacity of transmission facilities, efficient productive capacity of field, and peak daily withdrawal rate.

(10) In addition to the applicable information requested in parts (1) to (8), inclusive, submit the following information for operations involving the construction of dehydration, desulphurization, and field booster plants or facilities:

(a) Data on proposed plant facilities: (i) Gas processing, handling or delivery capacity; (ii) Sources and amounts of gas deliveries to plant; (iii) Disposition of all gas produced or processed; (iv) Flow sheet of process showing interrelation of equipment; (v) Identification and capacities of other plants performing the same function and operating in the same field.

(11) Add any other data or information which will assist in the determination of the importance of your proposed operation to the war program.

(12) Each application for an authorization shall bear the following certification executed in quadruplicate:

The undersigned hereby certifies to the Petroleum Administrator for War that:

(a) The foregoing application has been executed on behalf of and by authority of the above named applicant;

(b) The facts stated in the foregoing application are, to the best of my knowledge and belief, true and correct;

(c) If the authorization hereby applied for is granted, use of material existing in stock or obtained by means of any applicable allotment number or preference rating will be made solely in accordance with the terms of the authorization which has been granted, and with the provisions of Petroleum Administrative Order No. 11, as amended from time to time.

Name of Applicant

Signature of Authorized Official

Date

Title

Section 35 (A) of the United States Criminal Code, 18 U.S.C., Sec. 80, makes it a criminal offense to make a wilfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

PAW Form 4

Information Required to Obtain Exception for the Development of All or Any Portion of Any Oil, Gas, or Condensate Field

☆ ☆ ☆

Bureau of the Budget No. 42-R471
Approval Expires: March 31, 1944

Address three copies of all communications to the Director of Natural Gas and Natural Gasoline, Petroleum Administration for War, Interior Building, Washington, D. C. A fourth copy must be addressed to the District Director of Natural Gas and Natural Gasoline, Petroleum Administration for War, for the district in which the applicant's property is located.

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To obtain an authorization, as provided by Paragraph (c)(10) of Petroleum Administrative Order No. 11, for construction incident to the extraction of natural gasoline, it is necessary for the Petroleum Administration for War to determine the relationship of the specific case to other war needs. In order to perform this function, the Petroleum Administration for War must receive from the applicant a statement in quadruplicate containing the following information:

(1) Name and address of applicant.

(2) Name and location of field, property, plant or project and location to which material and equipment covered are to be shipped.

(3) List of all items of equipment or material for wells, lines, plant and auxiliary facilities segregated as to use, stating (a) description, such as would be given on a purchase order, (b) use or purpose, (c) specification, (d) composition, (e) weight and size, tabulated to show total weights of various critical materials involved, (f) cost, (g) schedule of required delivery dates, (h) total cost of all materials and equipment, (i) flow sheet of process showing interrelation of equipment.

(4) Brief Prospectus:

(a) Describe the proposed plant or project and its operation and purpose, including (i) Total cost; (ii) Gas processing, handling or delivery capacity; (iii) Sources and amounts of gas deliveries to plant or immediate system by ownership; (iv) Production, list products and production rates; (v) Disposition of all gas processed and of all products produced by the plant, showing volumes; (vi) Other results of project and operation; (vii) Names and capacities of other similar plants operating or under construction in the same field.

(b) Describe the oil and/or gas field

or reservoir (as a whole) and its development and operation, including (i) Estimates of oil and/or gas and condensate reserves; (ii) Gas analysis and recoverable liquid content; (iii) Original dissolved gas content of oil; (iv) Productive oil and/or gas acreage; (v) Plan of development and operation of field; (vi) Well spacing plan for producing and input wells; (vii) Number of oil and/or gas producing wells and of input wells; (viii) Names and addresses of principal operators; (ix) Rates of oil and/or gas and condensate production from the field and by principal operators; (x) Past production and production rates, reservoir pressure—original and current; (xi) Maps and sections, showing ownerships, wells and depths, structure, production horizons and thicknesses, productive area.

(c) All other data or information which will help to determine the importance and urgency of the project, including complete data on demand and utilization of gas and/or liquid products from the facility.

(5) Each application for an authorization shall bear the following certifications executed in quadruplicate:

The undersigned hereby certifies to the Petroleum Administrator for War that:

(a) The foregoing supplementary information has been submitted on behalf of and by authority of the above named applicant;

(b) The facts stated in the foregoing supplementary information are, to the best of my knowledge and belief, true and correct;

(c) If the authorization hereby applied for is granted, use of material existing in stock or obtained by means of any applicable allotment number or preference rating will be made solely in accordance with the terms of the authorization which has been granted, and with the provisions of Petroleum Administrative Order No. 11, as amended from time to time.

Name of Applicant

Signature of Authorized Official

Date

Title

Section 35 (A) of the United States Criminal Code, 18 U.S.C., Sec. 80, makes it a criminal offense to make a wilfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

TITLE 32—NATIONAL DEFENSE

CHAPTER XIII—PETROLEUM ADMINISTRATION FOR WAR

PART 1515—PETROLEUM PRODUCTION OPERATIONS

Supplementary Order No. 1 To Petroleum Administrative Order No. 11

General Exception Pursuant to Paragraph (c) (10) of Petroleum Administrative Order No. 11

Section 1515.7 Supplementary Order No. 1 to Petroleum Administrative Order No. 11.

(a) **Scope of this Order.**

Except as otherwise modified by the provisions of any other Order issued as a supplement to Petroleum Administrative Order No. 11 or by the provisions of any authorization issued pursuant to paragraph (c) (10) of Petroleum Administrative Order No. 11, the provisions of this Order shall, to the extent provided herein, be applicable to natural gas production operations in the Appalachian Region, southeastern Kansas, northeastern Oklahoma, and all of the State of Missouri, but not elsewhere.

(b) **Definitions.**

The definitions of Petroleum Administrative Order No. 11 shall apply in this Order. In addition:

(1) "Area One" means the area and formations specified in paragraph (a) of Exhibit "A" hereof.

(2) "Area Two" means the area and formations specified in paragraph (b) of Exhibit "A" hereof.

(c) **Gas Wells Drilled in Area One.**

Pursuant to paragraph (c) (10) of Petroleum Administrative Order No. 11, any person may accept delivery of, acquire, or use material for a natural gas production operation in Area One; *Provided*, that:

(1) Such material is used to drill, complete, equip, connect, or provide additions to any gas well in any gas field in conformity with a uniform well-spacing pattern, as defined by paragraph (d) of this Order, of not more than one single drilling or producible gas well to each 160 surface acres.

(2) Such material is used to plug-back, deepen, recondition, recomplete, rework, or treat a gas well only within that pool from which such well is producing or last produced, for the purpose of maintaining or increasing the productivity of such well.

(3) Such material is used to plug-back or deepen from one pool to another, recondition, rework, treat, equip, connect, or provide additions to any gas well spudded in Area One on or before December 23, 1941, where such well has attributed to it a drilling unit of at least 160 surface acres, no part of which is attributable to any other gas well.

(d) **Determination of Uniform Well-Spacing Pattern in Area One.**

Each gas well located in Area One on a drilling unit consisting of not less than 160 surface acres shall be drilled pursuant to paragraph (c) (1) of this Order in accordance with a uniform well-spacing pattern, only where:

(1) The drilling unit upon which such well is drilled consists entirely of acreage which is not attributable to any other gas well located on the same lease or property; and

(2) No other drilling or producible gas well is drilled or located on such drilling unit; and

(3) All separate property interests in the drilling unit upon which such well is drilled are first consolidated with each other; and

(4) No portion of the drilling unit attributed to such well falls within 660 feet of any other drilling or producible well located within the same lease or property; and

(5) Such well is drilled at least 1980 feet from every other drilling or producible gas well spudded subsequent to December 23, 1941, at least 990 feet from every other drilling or producible gas well spudded on or before December 23, 1941, and at least 990 feet from every drilling or producible oil well; and

(6) Such well is drilled at least 660 feet from every lease line, property line, or subdivision line which separates any unconsolidated property interests; and

(7) Such well is drilled with due diligence to maintain a vertical wellbore.

(e) **Gas Wells Drilled in Area Two.**

Pursuant to paragraph (c) (10) of Petroleum Administrative Order No. 11, any person may accept delivery of, acquire, or use material for a natural gas production operation in Area Two; *Provided*, that:

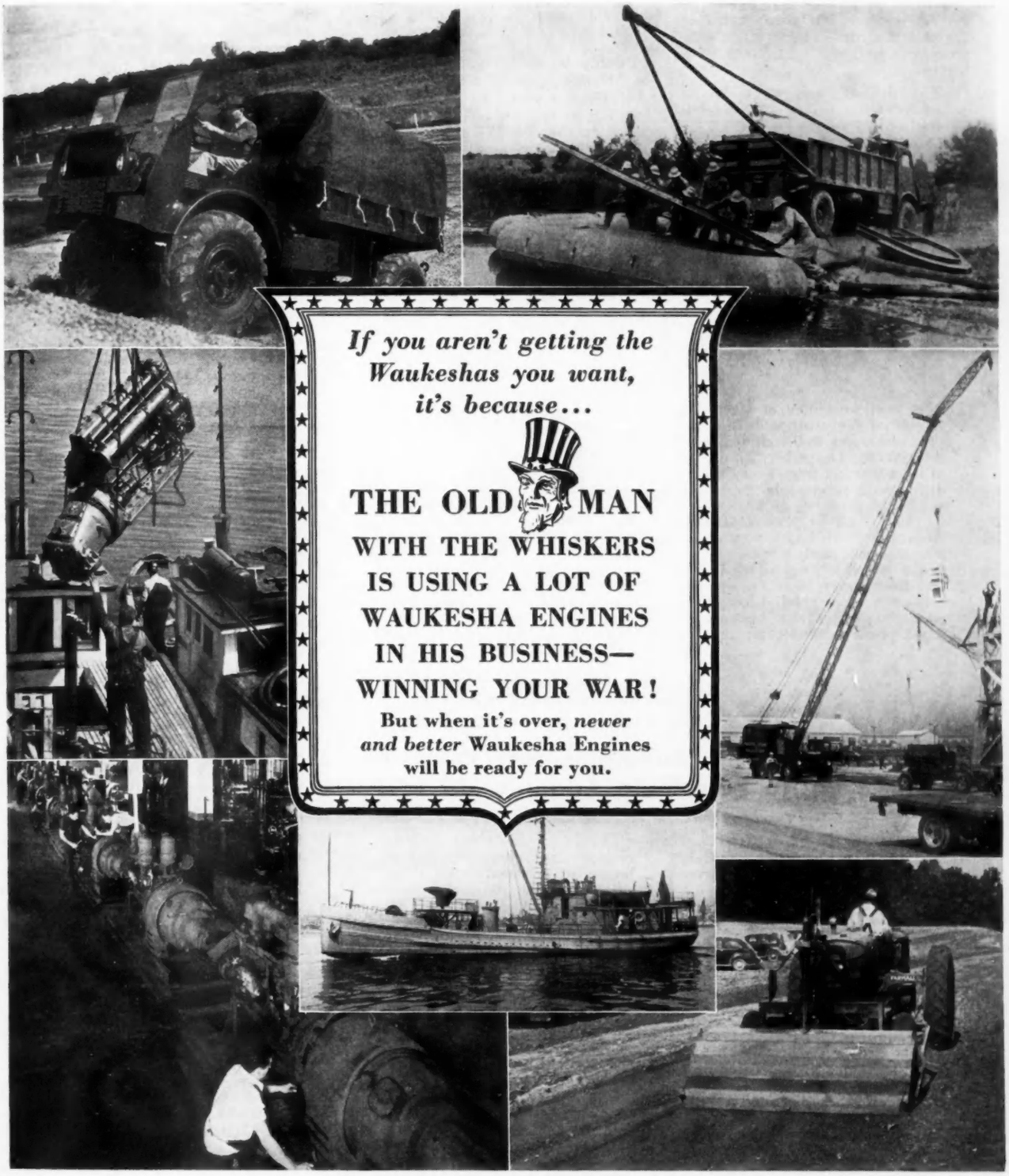
(1) Such material is used to drill, complete, equip, connect, or provide additions to any gas well in any gas field in conformity with a uniform well-spacing pattern, as defined by paragraph (f) of this Order, of not more than one single drilling or producible gas well to each 40 surface acres.

(2) Such material is used to plug-back, deepen, recondition, recomplete, rework, or treat a gas well only within that pool from which such well is producing or last produced, for the purpose of maintaining or increasing the productivity of such well.

(3) Such material is used to plug-back or deepen from one pool to another, recondition, recomplete, rework, treat, equip, connect, or provide additions to any gas well spudded in Area Two on or before December 23, 1941, where such well has attributed to it a drilling unit of at least 40 surface acres, no part of which is attributable to any other gas well.

(f) **Determination of Uniform Well-Spacing Pattern in Area Two.**

Each gas well located in Area Two on a drilling unit consisting of not


If you aren't getting the Waukeshas you want, it's because...
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But when it's over, newer and better Waukesha Engines will be ready for you.

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less than 40 surface acres shall be drilled pursuant to paragraph (e) (1) of this Order in accordance with a uniform well-spacing pattern, only where:

(1) The drilling unit upon which such well is drilled consists entirely of acreage which is not attributable to any other gas well located on the same lease or property; and

(2) No other drilling or producible gas well is drilled or located on such drilling unit; and

(3) All separate property interests in the drilling unit upon which such well is drilled are first consolidated with each other; and

(4) No portion of the drilling unit attributed to such well falls within 660 feet of any other drilling or producible well located within the same lease or property; and

(5) Such well is drilled at least 990 feet from every other drilling or producible gas well spudded subsequent to December 23, 1941, at least 990 feet from every other drilling or producible gas well spudded on or before December 23, 1941, and at least 990 feet from every drilling or producible oil well; and

(6) Such well is drilled at least 330 feet from every lease line, property line, or subdivision line which separates any unconsolidated property interests; and

(7) Such well is drilled with due diligence to maintain a vertical well-bore.

(g) **Computation of Attributable Acreage.**

(1) The acreage attributable to any well spudded on or before December 23, 1941, shall be determined by assigning to such well an acreage equivalent to that in the existing well density or drilling pattern contiguous to such well.

(2) The acreage attributable to any well spudded subsequent to December 23, 1941, shall be the same as the drilling unit assigned to such well pursuant to Conservation Order M-68, any Supplementary M-68 Order, any exception issued pursuant to a determination under Conservation Order M-68, or pursuant to Petroleum Administrative Order No. 11, or any exception or supplementary order thereto.

(h) **Violations.**

Any person who wilfully violates any provision of this Order, or who, by act or omission, falsifies records kept or information furnished in connection with this Order is guilty of a crime and upon conviction may be punished by fine or imprisonment. Any person who wilfully violates any provision of this Order may be prohibited from delivering or receiving any material under priority control, or such other action may be taken as is deemed appropriate.

(i) This Order shall be effective on and after March 31, 1943.

(E.O. 9276, 7 F.R. 10091; E.O. 9125, 7 F.R. 2719; sec. 2(a), Pub. Law 671, 76th Cong., as amended by Pub. Laws 89 and 507, 77th Cong.)

Issued this 30th day of March, 1943.

(SGD.) R. K. DAVIES

Deputy Petroleum Administrator for War.

* * *

Exhibit "A"

(a) Area One includes only the Onandaga Limestone, Oriskany Sandstone and Devonian Shale horizons in the States of Kentucky, New York, Ohio, Pennsylvania, and West Virginia.

(b) Area Two includes:

(i) Any horizons other than the Onandaga Limestone, Oriskany Sandstone and Devonian Shale horizons in the States of Kentucky, New York, Ohio, Pennsylvania, and West Virginia; and

(ii) Any horizon in the State of Missouri, that portion of the State of Kansas which lies east of Range Two (2) east of the Sixth Principal Meridian, and that portion of the State of Oklahoma included in the counties of Adair, Cherokee, Craig, Creek, Delaware, Mayes, Muskogee, Nowata, Okmulgee, Osage, Ottawa, Pawnee, Rogers, Sequoyah, Tulsa, Wagoner, and Washington.

TITLE 32—NATIONAL DEFENSE
CHAPTER XIII—PETROLEUM ADMINISTRATION FOR WAR
PART 1515—PETROLEUM PRODUCTION OPERATIONS

Supplementary Order No. 2 To Petroleum Administrative Order No. 11

General Exception Pursuant to Paragraph (c) (10) of Petroleum Administrative Order No. 11

Section 1515.8 Supplementary Order No. 2 to Petroleum Administrative Order No. 11.

(a) **Scope of this Order.**

Except as otherwise modified by the provisions of any other Order issued as a supplement to Petroleum Administrative Order No. 11 or by the provisions of any authorization issued pursuant to paragraph (c) (10) of Petroleum Administrative Order No. 11, the provisions of this Order shall, to the extent provided herein, be applicable to secondary recovery operations in the discovered oil fields of the States of New York and Pennsylvania and to the drilling, completing or providing of additions to oil wells in the discovered oil fields of the States of New York, Pennsylvania, and West Virginia, but not elsewhere.

(b) **Definitions.**

The definitions of Petroleum Administrative Order No. 11 shall be applicable in this Order.

(c) **Secondary Recovery Operations in New York and Pennsylvania.**

Pursuant to paragraph (c) (10) of Petroleum Administrative Order No. 11, any person may accept delivery of, acquire, or use material for secondary recovery operations by means of artificial water drive, gas drive, or air drive, in the discovered oil fields of Allegany and Cattaraugus Counties, New York, and McKean, Warren, Crawford, Forest, and Venango Counties, Pennsylvania.

(d) **Oil Well Drilling in New York, Pennsylvania, and West Virginia.**

Pursuant to paragraph (c) (10) of Petroleum Administrative Order No. 11, any person may accept delivery of, acquire or use material to drill, complete or provide additions to any oil well in any discovered oil field in the States of New York, Pennsylvania, and West Virginia, *Provided,* that:

(1) as to any such oil well which is drilled or completed at a depth of not more than 1000 feet:

(i) the drilling unit upon which such well is drilled consists of at least 5 surface acres upon which no other drilling or producible well is located;

(ii) all separate property interests in the drilling unit upon which such well is drilled are first consolidated with each other;

(iii) such well is drilled at least 400 feet from every other drilling or producible oil well;

(iv) such well is drilled at least 200 feet from every lease line, property line or subdivision line which separates any unconsolidated property interest.

(2) As to any such oil well which is drilled or completed at a depth of more than 1000 feet and not more than 2500 feet:

(i) the drilling unit upon which such well is drilled consists of at least 10 surface acres upon which no other drilling or producible well is located;

(ii) all separate property interests in the drilling unit upon which such well is drilled are first consolidated with each other;

(iii) such well is drilled at least 500 feet from every other drilling or producible oil well;

(iv) such well is drilled at least 300 feet from every lease line, property line or subdivision line which separates any unconsolidated property interest.

(3) As to any such oil well which is

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Surface Control
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IMMEDIATE AVAILABILITY

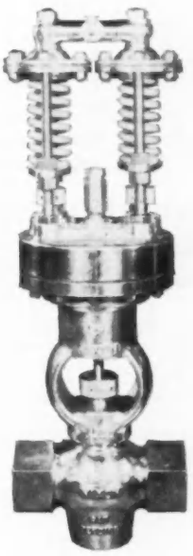
A minimum of metals and materials are required.

LOWEST INSTALLATION AND MAINTENANCE COST

Complete system can be moved to location on light pick-up truck. Installed quickly by a roustabout crew. No heavy foundation to build.

PRODUCE LARGE OR SMALL VOLUME

This system is producing wells from 3 barrels to 3000 barrels per day from high and low fluid levels. Will produce wells through stripper stage and to depletion.



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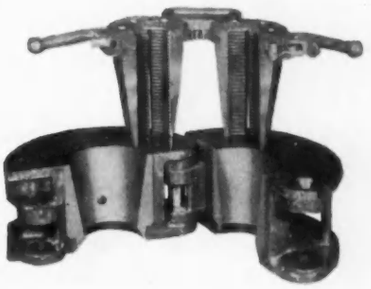
Due to design, troubles ordinarily caused by freezing are eliminated.



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DEEP WELL TYPE

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ARKANSAS—Magnolia

drilled or completed at a depth of more than 2500 feet:

(i) the drilling unit upon which such well is drilled consists of at least 20 surface acres upon which no other drilling or producible well is located;

(ii) all separate property interests in the drilling unit upon which such well is drilled are first consolidated with each other;

(iii) such well is drilled at least 660 feet from every other drilling or producible oil well;

(iv) such well is drilled at least 330 feet from every lease line, property line or subdivision line which separates any unconsolidated property interest.

(e) **Violations.**

Any person who wilfully violates any provision of this Order, or who, by any act or omission, falsifies records kept or information furnished in connection with this Order is guilty of a crime and upon conviction may be punished by fine or imprisonment.

Any person who wilfully violates any provision of this Order may be prohibited from delivering or receiving any material under priority control, or such other action may be taken as is deemed appropriate.

(f) This Order shall be effective on and after March 31, 1943.

(E.O. 9276, 7 F.R. 10091; E.O. 9125, 7 F.R. 2719; sec. 2(a), Pub. Law 671, 76th Cong., as amended by Pub. Laws 89 and 507, 77th Cong.)

Issued this 30th day of March, 1943.

(SGD.) R. K. DAVIES
Deputy Petroleum Administrator for War.

TITLE 32—NATIONAL DEFENSE
CHAPTER XIII—PETROLEUM ADMINISTRATION FOR WAR
PART 1515—PETROLEUM PRODUCTION OPERATIONS

Supplementary Order No. 3
To Petroleum Administrative Order No. 11

General Exception Pursuant to Paragraph (c) (10) of Petroleum Administrative Order No. 11

Section 1515.9 Supplementary Order No. 3 to Petroleum Administrative Order No. 11.

(a) **Scope of this Order.**

Except as otherwise modified by the provisions of any other Order issued as a supplement to Petroleum Administrative Order No. 11 or by the provisions of any authorization issued pursuant to paragraph (c) (10) of Petroleum Administrative Order No. 11, the provisions of this Order shall, to the extent provided herein, be applicable to "plug-back" operations in the Smackover Field of Ouachita and Union Counties, Arkansas, but not elsewhere.

(b) **Definitions.**

The definitions of Petroleum Administrative Order No. 11 shall apply in this Order.

(c) **Wells Located in the Smackover Field, Ouachita and Union Counties, Arkansas.**

Pursuant to paragraph (c) (10) of Petroleum Administrative Order No. 11, any person may accept delivery of, acquire, or use material to plug-back any well located in the Smackover Field of Ouachita and Union Counties, Arkansas, from the formation or formations from which such well is producing to any shallower formation or formations and to recomplete such well in such shallower formation or formations.

(d) **Violations.**

Any person who wilfully violates any provision of this Order, or who, by any act or omission, falsifies records kept or information furnished in connection with this Order is guilty of a crime and upon conviction may be punished by fine or imprisonment.

Any person who wilfully violates any provision of this Order may be prohibited from delivering or receiving any material under priority control, or such other action may be taken as is deemed appropriate.

(e) This Order shall be effective on and after March 31, 1943.

(E.O. 9276, 7 F.R. 10091; E.O. 9125, 7 F.R. 2719; sec. 2(a), Pub. Law 671, 76th Cong., as amended by Pub. Laws 89 and 507, 77th Cong.)

Issued this 30th day of March, 1943.

(SGD.) R. K. DAVIES
Deputy Petroleum Administrator for War.

TITLE 32—NATIONAL DEFENSE
CHAPTER XIII—PETROLEUM ADMINISTRATION FOR WAR
PART 1515—PETROLEUM PRODUCTION OPERATIONS

Supplementary Order No. 4
To Petroleum Administrative Order No. 11

General Exception Pursuant to Paragraph (c) (10) of Petroleum Administrative Order No. 11

The fulfillment of the requirements for the defense of the United States has created a shortage of materials necessary for the production of petroleum for defense, for private account, and for export; and the following order is deemed necessary in the public interest, to promote the national defense, and to provide adequate supplies of petroleum for military and other essential purposes.

Section 1515.10 Supplementary Order No. 4 to Petroleum Administrative Order No. 11.

Pursuant to Conservation Order M-68 as amended January 4, 1943 (section 1047.1), section 1047.8 (Supplementary Order M-68-3) is renumbered section 1515.10 of this chapter and is reissued effective March 31, 1943.

(E.O. 9276, 7 F.R. 10091; E.O. 9125, 7 F.R. 2719; sec. 2(a), Pub. Law 671, 76th Cong., as amended by Pub. Laws 89 and 507, 77th Cong.)

Issued this 30th day of March, 1943.

(SGD.) R. K. DAVIES
Deputy Petroleum Administrator for War.

Reprints of PAW Orders Available

Reprints of Petroleum Administrative Order No. 11, Supplement Orders 1, 2, 3, and 4, and PAW Exception Forms 3 and 4 (as shown on pages 102 through 110) and available at nominal cost.

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GIDDENS-LANE BLDG. **SHREVEPORT, LA.**

Stanolind Proposes 400-Mile 16-Inch Pipe Line from West Texas to Oklahoma

Facilities for the handling of from 54,000 to 116,000 barrels of West Texas oil daily have been authorized by Stanolind Pipe Line Company through construction of a 400-mile 16-inch trunk line from the Slaughter field, largest and most northern major field in the Permian Basin, to Drumright Terminal, near Cushing, Oklahoma, where connections can be made with all existing carriers serving the Mid-Continent.

It is understood that the project has been endorsed by PAW and that formal application is pending before WPB for priorities on the required pipe and station equipment.

This project is deemed the most effective and economical from standpoint of steel economy in making available the large oil reserves of the Permian Basin currently isolated from market by inadequate transportation. The proposed line will have a minimum capacity of 54,000 barrels daily, using four stations. Addition of 12 intermediate stations over a period of months after the line is placed in service would boost the maximum to 116,000 barrels daily.

The line would extend from the Hockley County sector of the field, where it would have access to all existing gathering facilities, thence northeast across Southwest Oklahoma to Drumright Terminal.

Movement of Permian Basin crude to the Mid-Continent thence to Middle-West and Eastern refineries is now restricted to 48,000 barrels daily through Shell Pipe Line Corporation's 10-inch unit, originating at McCamey, and 13,000 barrels daily handled by Humble Pipe Line Company for account of Stanolind Pipe Line Company, which accepts delivery into its Mid-Continent sour oil stream at Ranger. Prior to completion of the big-inch line from East Texas, Atlantic Pipe Line Company was routing 15,000 barrels of Permian Basin crude daily through its carrier to Beaumont, thence through a reversed line terminating in the Neale field, Beauregard Parish, Louisiana, where the oil was loaded into tank cars for consignment to Atlantic Refining Company's refinery at Philadelphia.

Upon completion of Stanolind Pipe Line Company's direct outlet from the Permian Basin, it will eventually be extended south to connect with Stanolind Oil & Gas Company's extensive properties between Slaughter and Yates fields. Stanolind Pipe Line Company operates gathering lines in the Slaughter and Cedar Lake fields, and the runs are routed through The Texas-New Mexico Pipe Line Company and Atlantic Pipe Line Company to storage at Beaumont. Gathering lines in Winkler and Ward counties deliver to Humble Pipe Line Company, while a recently acquired unit in Pecos County connects with Shell Pipe Line Corporation.

Better Crude Prices and Unitization Urged at Compact Commission Meeting

Better prices for crude oil as a means of encouraging wildcat development and general adoption of legislation which would permit unitization of oil fields were urged at a meeting of the Interstate Oil Compact Commission held in Wichita, Kansas, last week.

At informal conferences held before the session opened, state officials as well as oil operators expressed the opinion that there was little hope for more drilling until the price is increased materially. Most observers believed that 25 to 50 cents a barrel increase would be necessary to obtain the results desired.

General adoption of legislation that would permit the unitization of oil field was urged April 3 by William B. Heroy, PAW director of reserves, in a paper that also reflected the need for more wildcatting.

Heroy pointed out that there are fewer wildcats being drilled, and the average potentials of new wells had dropped from 1077 barrels per well in 1937 to 59 barrels in 1942. Thus it would be necessary to discover many more fields if flush production is to be maintained.

Outlining the methods followed in the computation of estimates of reserves and stressing the conclusion to be drawn from the trend of new discoveries, initial production and other factors, Heroy pointed out that analysis shows that not only have we not discovered anywhere near the amount of oil we have produced in the past three or four years but that practically all increases in reserves, and especially those resulting from new discovery, are concentrated in Texas and Louisiana, while the reserves of District 2 have remained about stationary, while those of California have somewhat decreased. The maximum increase in reserves, accordingly, being concentrated in the area farthest from the Eastern seaboard center of demand.

While the decrease in the discovery rate would not of itself be cause for undue alarm if it were possible to increase at will the rate of production, when the country's fields are considered collectively there is a normal decline in production from one year to the next of about 400,000 barrels per day in productive capacity, he told the state authorities.

"If capacity is to be fully maintained it is necessary each year to find new fields and drill new wells to offset this normal decline," Heroy said, "and if productive capacity is to be further increased to meet war demands, then discovery and development must be further accelerated.

"When it is considered that it is the relatively young wells which yield the flush production and that we are dependent on such wells for 85 percent of our production, the decline in initial production becomes cause for serious concern.

"It is, therefore, incumbent upon those of us here present, representing both state and federal authorities, to place ourselves squarely behind every measure that will stimulate new discovery and increase productive capacity. Laws that will bring about conservation to prevent the dissipation of reservoir energy and that will permit the unitization of oil fields are urgently needed in several states. Unitization is not an end in itself but the vehicle whereby productive capacity can be increased, the use of critical materials minimized and manpower requirements reduced."

Most of the meeting centered around proposals for an educational program to be sponsored by the Compact. It is to stress the desirability of conservation, that conservation is a state function being handled well by state regulatory authorities, that the Compact supplies a forum for study of general conservation problems, and that the industry is furnishing a vital commodity efficiently and at low cost.

Plans for the preparation of sound films were discussed and Compact representatives saw "Evolution of the Oil Industry," a film prepared by Sinclair, and "Oil as Produced," an Humble Oil & Refining Company picture, which were shown as examples of the work contemplated.

New Oil Possibilities in District 4 Studied

Calling upon Rocky Mountain operators for a greatly expanded wildcatting campaign in 1943, members of the District 4 Production Committee met in Denver last week and reviewed prospects for increasing production in that area. The District PAW Materials Division promised every assistance in securing equipment and supplies for exploratory wells.

This action is in line with Administrator Ickes' challenge to the industry to drill 4500 wildcats in 1943.

"O. D. Donnell, chairman of the national production committee, and W. B. Heroy, PAW Director of Reserves, are looking to the Rocky Mountain area for a substantial increase in discovery of new reserves," R. S. Shannon, chairman of the district production committee and president of Minnelusa Oil Corporation, Denver, said. "District 4, embracing Colorado, Idaho, Montana, Utah and Wyoming, contains more potential land to be explored than any other district with the exception of District 2 which includes Texas."

Shannon called attention to the increased demands of Canadian refineries for crude oil, the Alcan highway for petroleum products and the probable call of the Pacific Northwest area upon District 4 for supplies. "These are factors that should immediately stimulate wildcatting in District 4 and the increased Canadian demands," he continued, "should be a real and immediate stimulus to wildcatting in northern Montana."

John B. Schuyler, director of materials, District 4, who attended the meeting, said "the materials division of District 4 is very anxious to assist the petroleum industry in securing materials for all operations, especially exploratory wells or wildcats. I know this is the wish of Washington and we are endeavoring to comply in every way possible."

Heavy Fuel Oil Again Taken from Storage In Spite of Sharply Increased Production

In spite of sharply increased crude runs to refinery stills (to a new high for this year), there were withdrawals from storage of each of the three major petroleum products in the week ended March 27. The larger runs made possible a substantial increase in production of needed residual fuel oil to a level of 26 percent above that a year ago, but the output of that product still was not great enough, and it was necessary to take 240,000 barrels more from storage. The production for the week was 8,018,000 barrels, 706,000 more than in the previous week and 1,674,000 barrels (26.3 percent) more than the output of 6,344,000 barrels in the week ended March 28 last year. Following the 240,000 barrel withdrawal from stocks for the week, inventories of the nation stood at 67,938,000 barrels—15,107,000 or 18 percent less than the 83,045,000 barrels on hand March 28, 1942.

United States stocks of gas oil and distillate fuel were lowered 762,000 barrels in the week of March 27—from 31,742,000 to 30,980,000 barrels, as production at refineries was cut down 281,000 barrels compared with the previous weeks's output in totaling 3,541,000 barrels. The latter quantity was 120,000 barrels (3.2 percent) less than that of 3,661,000 barrels made in the week ended March 28 last year. The present stocks are 776,000 barrels (2.4 percent) less than those held a year ago.

Gasoline stocks again were lowered, although they normally continue to increase in late March and early April. They were reduced from 94,159,000 to 94,079,000 barrels, a decrease of 80,000 barrels, and they then stood 13,083,000 barrels (12.2 percent) under the level of 107,162,000 barrels recorded for March 28 last year. This reduction of inventories is fairly well in line with the curtailment of demand. Production at refineries was down by exactly the same percentage from a year ago in totaling 10,231,000 barrels for the week. That quantity was 30,000 barrels less than the production in the previous week and 1,432,000 barrels less than the output in the week ended March 28 last year.

Crude runs to stills averaged 3,742,000 barrels per day, having been stepped up 124,000 barrels from the previous week's rate of 3,618,000 barrels daily. The runs were 109,000 barrels (3 percent) greater than those of 3,633,000 barrels per day in the week ended March 28, 1942. This increase reflects the fact that overall demand for petroleum is around the levels of a year ago, in spite of the curtailment of civilian consumption of gasoline and fuel oil, although the industry was drawing on stocks more heavily a year ago than it currently is doing, because of the present limited inventories.

United States production of crude oil averaged 3,896,000 barrels daily in the week ended March 27, down 80000 from the previous week but 76,000 barrels per day (2 percent) more than in the corresponding week a year ago. The present trend of production, above the year ago trend, fulfills earlier expectations that the wells of the country would have to put out more oil than in 1942,

Crude Oil Production in the United States

(Estimates compiled by The Oil Weekly. All figures indicate daily averages, in barrels.)

STATE OR DISTRICT	*State Allowable of Crude Production	PRODUCTION IN WEEK ENDED March 27	April 7
Arkansas	72,337	70,850	70,900
California	780,200	800,300	780,100
Long Beach		33,250	33,200
Midway-Sunset		59,450	58,900
Kettleman Hills		45,300	45,150
Wilmington		95,350	95,050
Rest of State		566,950	547,800
Colorado		6,550	6,300
Illinois		228,650	238,300
Salem		30,600	31,300
Louden		39,900	37,100
Other New Pools		146,600	158,300
Old Pools		11,550	11,600
Indiana		13,400	15,700
Kansas	304,900	308,900	314,800
Kentucky		12,950	13,000
Louisiana	326,648	340,100	340,100
North		89,050	89,200
South		251,050	250,900
Michigan		54,200	56,300
Mississippi		53,450	54,600
Missouri		95	95
Montana		18,500	22,550
Nebraska		2,100	2,150
New Mexico	100,000	92,450	92,350
New York		15,300	14,150
Ohio		11,350	11,500
Oklahoma	360,900	345,650	344,000
Oklahoma City		59,200	59,950
Seminole Area		79,500	79,650
Rest of State		206,950	204,400
Pennsylvania		45,800	45,450
Tennessee		35	35
Texas	1,383,376	1,393,350	1,394,700
Upper Gulf Coast		352,850	353,000
East Texas Field		323,750	323,650
Rest of Eastern Texas		100,050	100,200
Lower Gulf Coast		106,050	106,300
Southwest Texas		50,700	50,950
South Central Texas		17,100	17,250
West Texas		217,050	217,350
North Texas		136,950	137,200
Panhandle		88,850	88,800
Utah		10	10
West Virginia		9,950	9,050
Wyoming		93,550	93,300
Total 8 Prorated States	3,387,511	3,351,600	3,336,950
Total United States		3,917,490	3,919,440

* Details on state allowable in Oil Weekly of March 15, page 44.

Trends of Operations and Changes in Stocks

Figures on crude stocks are from Bureau of Mines weekly reports; all others from American Petroleum Institute weekly reports, which are estimates on Bureau of Mines basis.

(All figures in thousands of barrels—add 000)

ITEM	Crude Oil Prod. Barrels Daily	Crude Oil Prod. Week Ended	Runs to Stills Barrels Daily	Runs to Stills Week Ended	Crude Stocks Barrels	Crude Stocks Week Ended	Gasoline Stocks Barrels	Gasoline Stocks Week Ended	Gas Oil & Distillate Stocks Barrels	Gas Oil & Distillate Stocks Week Ended	Residual Fue Oil Stocks Barrels	Residual Fue Oil Stocks Week Ended
Highs:												
1939	3,910	8- 5	3,650	10-21	278,607	5-26	87,769	4-22	39,562	10-28	116,237	8-26
1940	3,890	3-16	3,690	6-22	265,865	8-31	102,817	4-20	49,051	10-19	109,135	9-14
1941	4,337	11-22	[1]4,120	10-18	266,187	3-29	99,727	3-29	[1]54,983	11-15	102,448	1- 4
1942	[1]4,337	2- 7	3,961	1- 3	263,208	3-28	[1]109,281	3-14	49,861	11-14	95,857	1- 3
1943	3,904	3-20	3,742	3-27	238,417	3-20	94,159	3-20	42,913	1- 2	72,881	1- 2
Lows:												
1939	[2]1,601	8-26	3,125	2-18	[2]229,127	10-12	71,152	10- 7	20,722	4-15	105,397	4- 8
1940	3,335	11-30	3,370	1- 6	237,339	1-27	79,847	11- 9	23,551	4- 6	102,344	2-10
1941	3,364	1-11	3,490	1-18	240,399	11-15	79,923	10- 4	28,381	4-12	90,914	7-12
1942	3,297	7- 4	3,393	5-23	231,896	12-12	75,934	12- 5	29,240	4-25	72,962	12-26
1943	3,821	1- 9	3,579	3-13	232,191	1- 9	82,420	1- 2	30,980	3-27	67,938	3-27

Trends in Week Ended:	Crude Oil Production Daily	Crude Oil Runs to Stills Daily	Crude Oil Stocks Week End	Gasoline Production Weekly	Gasoline Stocks Week End	Gas Oil and Distillate Production Weekly	Gas Oil and Distillate Stocks Week End	Residual Fuel Production Weekly	Residual Fuel Stocks Week End
1942:									
January 3	4,038	3,961	244,440	13,797	92,987	3,855	49,357	6,918	95,857
January 31	3,871	3,848	250,740	13,292	97,810	3,817	40,674	6,640	91,189
February 28	4,016	3,675	259,373	12,131	105,635	.....	34,547	.....	88,285
March 28	3,820	3,667	263,208	11,663	105,624	.....	31,756	.....	83,045
April 25	3,581	3,506	257,073	10,535	102,897	.....	29,240	.....	81,107
May 30	3,877	3,522	255,023	10,478	95,355	.....	31,384	.....	79,628
June 27	3,719	3,581	253,364	10,713	88,396	.....	32,851	.....	77,304
July 25	3,691	3,658	249,262	10,864	82,281	.....	35,966	.....	77,816
August 29	3,964	3,697	249,007	11,300	80,831	.....	42,060	.....	78,034
September 26	3,909	3,802	242,785	10,954	80,550	.....	45,945	.....	78,943
October 31	3,901	3,731	239,266	11,153	79,159	.....	48,131	.....	79,166
November 28	3,878	3,736	234,850	11,269	78,854	.....	49,739	.....	77,796
1943:									
January 2	3,871	3,734	233,938	10,957	82,420	4,285	42,913	7,683	72,881
January 30	3,826	3,698	233,863	10,339	88,830	3,888	37,057	7,452	70,763
February 27	3,873	3,709	235,217	10,566	93,157	4,230	32,939	7,839	70,140
March 6	3,887	3,626	235,686	10,058	92,845	3,731	31,668	7,106	68,782
March 13	3,877	3,579	236,655	10,071	94,161	3,879	32,629	7,145	68,243
March 20	3,904	3,618	238,417	10,261	94,159	3,822	31,742	7,312	68,178
March 27, 1943	**3,896**	**3,742**	.....	**10,231**	**94,079**	**3,541**	**30,980**	**8,018**	**67,938**
March 28, 1942	3,820	3,633	[4]261,724	11,663	107,162	3,661	31,756	6,344	83,045
Change:									
In week	—8	+124	+1,762	—30	—80	—281	—762	+706	—240
In year	+76	+109	—23,307	—1,432	—13,083	—120	—776	+1,674	—15,107
In year	+1.9%	+3.0%	—8.9%	—12.2%	—12.2%	—3.2%	—2.4%	+26.3%	—18.1%

[1] All time peak. [2] Lowest since April, 1922. [3] Lowest since October, 1922, due to shutdown of six Mid-Continent States. [4] Stocks, March 21, 1942.

because of heavy wartime demand for petroleum and because of the virtual shutting off of imported crudes from South America and other countries.

Stocks of crude oil in the United States were increased 1,762,000 barrels in the week ended March 20, latest period for which figures are available. They rose from 236,655,000 to 238,417,000 barrels, and then were 3,000,000 barrels larger than 2 weeks before. The crude inventory is, however, 23,000,000 barrels (9 percent) smaller than at this time last year.

M. D. BRYANT, San Angelo, Texas, operator who discovered the St. Jacob field in Illinois, has made a portion of his West Texas ranch available for experimental cultivation of guayule, under the direction of the U. S. Bureau of Plant Industry.

Markets Continue Generally Tight; California Crude Oil Prices Raised

While increased prices for heavy crudes in California are expected to draw forth extra production and better meeting of demand, the markets in all districts east of California are extremely tight, demand for gasoline being on the rise and takings of both light and heavy fuel oils showing no abatement. Refiners are of the opinion that spring and summer will not bring any let-up in demand for the fuel oils, anticipating that there will be ready absorption of available supplies for storage to take care of next winter's requirements in the East and North.

Increased prices posted by Standard Oil Company of California effective April 1 established new higher levels for California heavy crude to a range of 93 cents to $1.01 per barrel. The new posting provided for a 25-cent inncrease on 14 and 15 gravity oils. The new 15 gravity price in each field also applies to gravities above 15 which heretofore carried a price lower than the new 15 gravity figure. The effect of this is to allow for graduated increases which carry the adjustments in most Southern California fields up to the range of 21 to 23 gravity. In the San Joaquin Valley there are some instances where adjustments will include crudes up to 26 gravity.

At the same time, Standard of California posted increases of 25 cents a barrel for fuel oils and $1.50 per ton for asphalt. The fuel oil increase is offered for standard fuel oil, light fuel oil, and Navy special fuel oil. These increases became effective on all forms of delivery in California, Oregon, Washington, Nevada, Arizona, Alaska, and Hawaii.

Late last week other major companies intimated that the Standard schedule was satisfactory, and it was anticipated that the schedule would be followed without exception.

In the East Coast district the demand for light fuel oils and kerosene appeared to be somewhat diminishing, in reflection of warmer weather. But gasoline was extremely scarce, with some suppliers indicating that they were desperately short.

In Western Pennsylvania there was less difficulty in meeting gasoline demand, with consumption curtailed under rationing. However, supplies of practically all products were tight. Markets for lubricants were firm. Bright stocks and cylinder oils were scarce, and neutral oils were in better demand, following their long weakness.

Gasoline was very scarce in some sections of the Middle West, with some refiners completely sold out, although other suppliers reported that they had not encountered any sharp increase in demand. Inquiries for tractor fuels were increasing. Meanwhile, fuel oils, light and heavy, continued in strong demand.

Mid-Continent refiners still had difficulty in meeting the strong demand that prevailed generally on all products. There was ready market for gasoline and no let-up in demand for light fuel oil, while heavy fuel continued definitely short. Good demand for lubricants also prevailed.

Markets of the Gulf Coast remained relatively inactive, although there was a continuation of revived interest in heavy fuel oils for shipment by tanker.

North Texas Line

Shell Pipe Line Corporation is laying a 5-mile 3-inch oil line from the New York City pool, Clay County, North Texas, to connect with Magnolia Pipe Line Company's trunk line, thus eliminating tank trucks for marketing the oil. The field has 10 wells with a base allowable of 652 barrels daily.

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More States Included in California Price Increase

An order making the March 26 increase in California ceiling prices (THE OIL WEEKLY, March 29) applicable all along the line nad extending the increase to Washington, Oregon, Nevada and Arizona, was issued by OPA April 1, after the receipt of complaints that as issued the original order limited the increase on residual fuel oils to refiners and that, as well as the increase on heavy crude at the well, was restrictd to Cealifornia. Immediately after this OPA order, Standard Oil Company of California announced revised crude price schedules (see market section, this issue).

The amendment extends the increases to include all sellers of these oils through District 5, but specifies that the increases cannot be used as the basis for an increase in the price of dry gas in that area, although in the past it has been customary for the industry to write contracts for dry gas at prices bearing a specified relationship to, and fluctuating with, the prices of residual fuel oils.

Independent Producers Put Price Resolution to Ickes

Headed by F. G. Buttram, a delegation from the Independent Petroleum Association met with Administrator Ickes April 2, for a discussion of the price problem from the independent operator's point of view.

A resolution adopted at a recent meeting was laid before Ickes, dealing with question of production as affected by price.

Members of the delegation included Don T. Andrus, Bradford, Pennsylvania; H. M. McLure, Alma, Michigan; M. W. Shiarella, Owensboro, Kentucky; E. B. Shawver, Wichita, Kansas; Major B. A. Hardey, Shreveport; F. J. Danglade, Lovington, New Mexico; C. D. McGaha, Wichita Falls, Texas; H. C. Cockburn, Houston; J. K. Brim, Sulphur Springs; J. P. Coleman, Wichita Falls; John B. Cowden and Walter Lechner, Dallas; J. Garfield Buell, Tulsa, and O. L. Sturbois, Vincennes, Indiana.

Strict Fuel Rationing for Pacific Northwest

Military demand and uncertain tanker shipments make it impracticable to relax rationing restrictions in Washington and Oregon, it was disclosed April 1, by Deputy Administrator Davies, who urged consumers in these states to stock up on fuel against next winter.

Commenting on the situation in the northwest, Davies warned that at any moment war demands may force the diversion of the tankers on which it is dependent and if that happens fuel oil supplies in the two states will rapidly be depleted.

"In view of this condition," he said, "PAW sees no possibility of relaxing fuel oil restriction in Washington and Oregon. In fact, it is the carefully weighed advice of this office to residents of Washington and Oregon to do everything possible now to save fuel oil this coming winter."

At the same time, PAW officials disclosed that they had recommended to OPA that Bluefield, West Virginia, and Sharon and three surrounding communities in Pennsylvania be removed from the Eastern rationing district.

F. H. SABOURIN is now in charge of the Midland, Texas, office for Darby Petroleum Corporation. He was formerly general superintendent for Harry Stekoll, oil producer.

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BIG-INCH PIPE LINE ELECTRICALLY OPERATED

On the 531-mile stretch of the Big-Inch pipe line now being completed between Longview, Texas, and Norris City, Illinois, it is planned to use all electrically driven pumps. Preliminary plans also call for electrifying stations as the line is completed from Norris City, to the Atlantic Coast. A fine recommendation for Utility Electric Power!

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U. S. Field Operations

Illinois Basin

Two White County Wildcats Abandoned

Bonnie Heath's Miller 1, SE NE SW 26-4s-9e, 3 miles southwest of the Centerville pool, White County, has been plugged at 3357 feet. A light show was found in Tar Springs but the McClosky lime carried salt water.

Cumberland County: Kingwood Oil Company's Massie 1, SW NW 12-9n-8e, had a derrick on location. Another wildcat, Northern Ordnance Company's O'Conner 1, 28-9n-8e, was drilling below 1100 feet.

Clay County: A Devonian wildcat in the Zeia area, Northern Ordnance Company's Sapp 1, C SE SE 5-2n-5e, was drilling below 2500 feet.

Franklin County: Seaboard Oil Company's U. S. Coal and Coke 9, NE NE NE 26-6s-4e, second producer in the new field south of the Akin pool, was filling up with oil at the rate of 500 feet an hour. Producing formation is the Aux Vases sand at 3126 feet. The company's third test in the area, U. S. Coal and Coke 10, NE SE NE 26-6s-4e, was drilling below 1110 feet.

E. S. Adkins' Brown Estate 1, SE NE NW 25-7s-2e, pool opening well near West Frankfort, pumped 130 barrels of oil in 24 hours from Lower O'Hara lime at 2756-64 feet but pump was being pulled to rework the well. The operators believed production could be increased.

Marion County: Cameron's Binion 1, SW NW SW 2-4n-1e, a Shell farmout, was abandoned at 1770 feet with the Lower Mississippian topped at 1763 feet. The test was a wildcat north of Patoka.

Hamilton County: The Texas Company's Mann 1, SE NW NE 21-6s-6e, a wildcat, was plugged at 3375 feet after finding only a slight show in McClosky.

Oklahoma

Wild Garvin County Well Has Heavy Gas Volume

Ohio Oil Company's Burns 1, SE NE SW 17-3n-2e, Garvin County, a wildcat east of Pauls Valley, has blown out from a Pennsylvanian sand at 2876 feet. Gas volume has been variously estimated at between 30,000,000 and 100,000,000 cubic feet, no accurate gauge being possible. The test is on a seismic structure located a few years ago and re-examined recently in detail with the same instrument. More than a year ago the company drilled a dry hole 1¾ miles west of the gas well, the original test being on the same structural feature. The blowout occurred when rotary tools entered the sand and showed some slight saturation of oil. In going in to core, the fluid backed up and the well went out of control.

Lincoln County: Stanolind Oil & Gas Company has set 7-inch pipe at 5635 feet at Leonard 1, SWc 10-12-2e, which showed 1330 feet of high-gravity oil in the hole from first Wilcox sand topped at the above depth. Drill stem was open 50 minutes. No water showed. Bottom is at 5644 feet, still in the sand.

Oklahoma County: Ace Gutowsky's Wagner 1, NWc SW 32-14-4w, 3 miles west of Edmond field, found second Wilcox tight and dry on core test to 7685 feet. Hole is now being plugged back for a test of Hunton lime, which indicated saturation between 6877 and 7231 feet.

Pottawatomie County: Stanolind Oil & Gas Company and Amerada Petroleum Corporation's Crossland 1, NW NE NW 33-10-2e, in the first section south of the discovery well of Lake Shawnee field, the only producer into the pay, is drilling below 5500 feet and is running low on the deeper markers.

Kansas

Stark Gas Field Gets Oil in Extension Well

Oil has been found in the Stark gas field of the northern part of Pratt County. Viola lime had previously been proven productive of gas but exploration had failed, until the current test, to open any oil production. Lion Oil Refinig Company's Ford 1, NE NE SE 12-26-12w, one mile north and west of the field, topped Viola lime at 4135 feet and drilled to 4144 feet. On 25-minute test the well made 2200 feet of oil into casing without indicating any water. Ward gas field is three miles west of Stark. These two, in relation to the current strike, form a triangle that may see considerable development dependent upon satisfactory completion of Ford 1.

Champlin Refining Company is adding an Arbuckle well at Steuder 1, SW SE SW 29-26-12w, which is being completed at 4297 feet in the sand topped at 4271 feet. This well is in the Iuka North extension area.

Stanolind Oil & Gas Company is preparing to spud at Frisbie 1, C SE SW 5-26-13w, northwest of Iuka production. This area is witnessing increased activity throughout five connected townships all geologically related.

Russell County: Just east of edge production in Gorham and south of Russell, Alva Billings has opened new production of Krug 1, NEc SW 8-14-14w, in Lansing-Kansas City lime with a 63-barrel producer. Pay was at 3034 feet, with productive limits of the discovery apparently limited to a small area.

Stafford County: Stanolind Oil & Gas Company and Derby Oil Company's Van Lieu 1, NE SE NE 20-24-13w, has been given a state potential of 104 barrels daily from Arbuckle dolomite at 4079 feet. The well is nearly 1 mile northwest of St. John field and is more probably an extension than a new field.

New Mexico

Ordovician Test Shows Oil at 3248 Feet

Lea County: Continental et al's Eaves 1-B-31, C NW NE 31-26s-7e, extended Eaves pool ¾-mile south to indicate its connection with Eaves pool in Texas in testing 75 barrels oil and 32 barrels water daily on gas lift. Production is from Permian 3192-3248 feet. Pump will be installed.

R. Olsen Oil Company and Atlantic Refining Company's Langlie 1, east edge of Langlie field and deepest test in state, landed 5½-inch in granite at 9590 feet, two feet off bottom. Produc-

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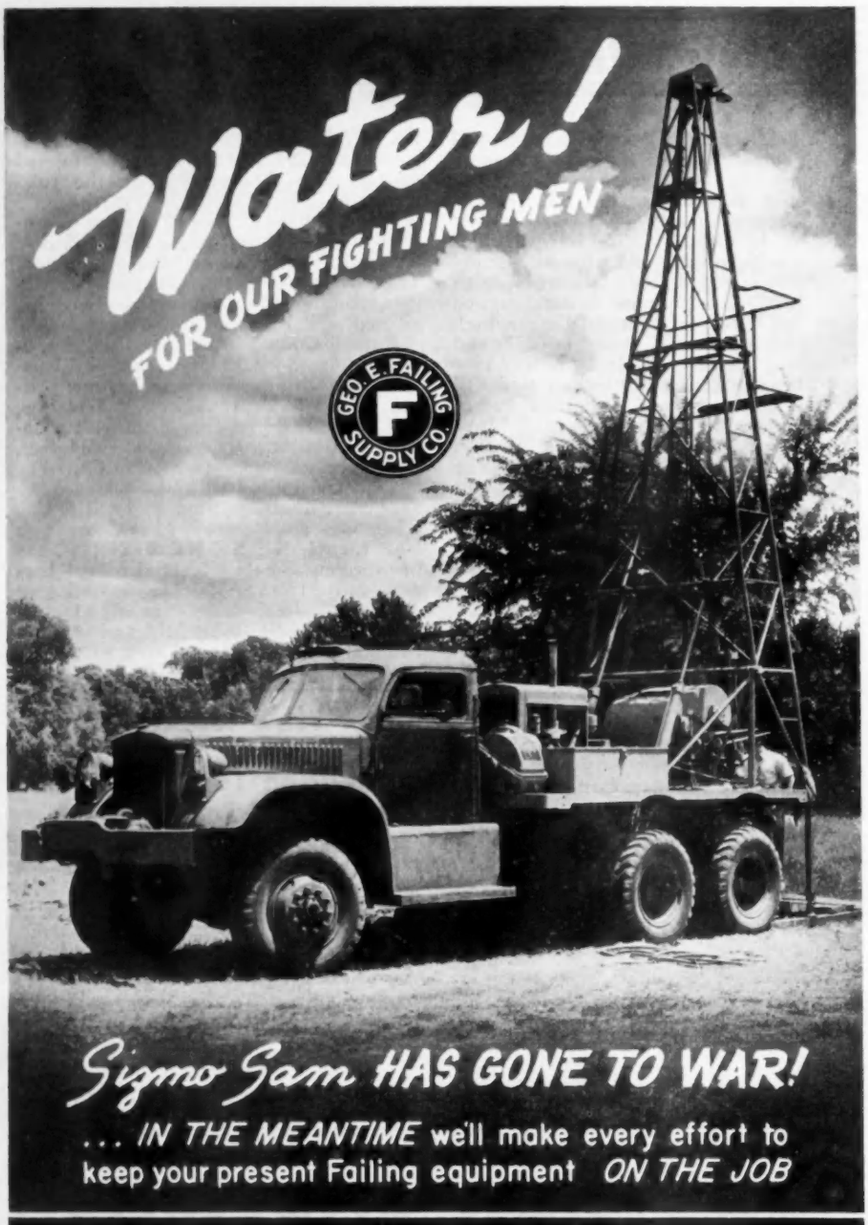
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tion test will be made through perforations opposite nominal saturation in Ellenburger, topped at 9105 feet, with more favorable prospects for production in Simpson and Lower Permian.

Otero County: H. L. Hunt's Interests' McMillen-Turner 1, C SW SE 5-26s-16e, entered granite wash at 2060 feet, and abandoned in granite at 2175 feet.

San Juan County: Continental-Stanolind-Standard of Texas' Tocito 1, C NW SW 17-26n-18w, currently the deepest active test in state, drilling lime and shale 6577 feet.

Eddy County: S. P. and Martin Yates Jr. et al's Evans 3, projected 5000-foot test for west edge of Square Lake field, drilling lime 4735 feet.

West Texas

Big Pay Area Indicated by Ellenburger Winkler Test

Amon G. Carter et al's Walton-Pure 2-C, recent Ellenburger discovery gas-distillate producer in the Keystone field, Winkler County, was temporarily halted at 9316 feet to run electrical formation survey and velocity test. The fifth and final drill-stem test at 9285-9316 feet rated gas yield at 10,000,000 to 15,000,000 feet daily, and 16 barrels of 58-gravity distillate hourly. Top of Ellenburger has been corrected from 9217 to 9230 feet with elevation of 2955 feet. Tester was first used at 9176-9234 feet, resulting in 5,000,000 feet gas with distillate spray. The well was deepened by coring, and given drill-stem test after each core. High-pressure gas and distillate showed on each test. Open hole prevails below the 9⅝-inch seat at 3600 feet.

Development of attractive oil production below the gas-distillate pay can be assumed with a reasonable degree of certainty. The area is likely to involve an over-all pay of several hundred feet, and a productive area of 6000 to 8000 acres. Carter holds lease on 1440 acres that was farmed out by Pure Oil Company in 1936, with the latter retaining ⅛ over-ride until development costs are amortized by production, then the property will be owned 50-50. Sid Richardson, Gulf Oil Corporation and Standard Oil Company of Texas are the largest acreage owners.

Magnolia Petroleum Company's Walton-State 20, 3 miles west of the Keystone discovery, was drilling 10,225 feet in McKee, topped at 9920 feet. Ellenburger is due near the 10,500-foot level.

Pecos County: Magnolia Petroleum Company's Eaton 1-29, 5 miles southwest of Abell field, was awaiting drill-stem test at 8182 feet in Ellenburger, topped at 8110 feet with elevation of 2430 feet. Nominal oil stain and odor was evident in last core. This wildcat went out of Permian at 5410 feet, then encountered thick section of chert, Montoya and normal Simpson beds, while the company's Eaton 2-23, situated 2 miles east by south, logged Permian-Ellenburger contact at 5120 feet, and quit at 5171 feet. Phillips Petroleum Company's Price 1, southeastern Pecos County, was due to resume drilling at 10,008 feet after cementing protection string of 8⅝-inch at 6901 feet account of cavings. Standard of Texas's Douglas 1, projected Ordovician test on southwest edge of Yates field, drilling lime 4840 feet.

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North Texas

Young County Wildcat Has Prolific Oil Flow

Fleming Oil Company et al's Graham 2, 8½ miles southwest of New Castle, in Young County, strengthened its bid for a pool opener in swabbing 20 barrels of oil and 35 barrels of water initial after using 1500 gallons of acid in Bend at 3800-3809 feet. Pumping unit will be installed to try and exhaust water, but if unsuccessful the wildcat will be deepened.

Bobby Burns et al's Rogers 1, northeast edge of the Burns-Ragland pool, flowed 342 barrels natural on three-hour test through ¾-inch, then flowed 83 barrels the next hour through one-eighth-inch choke. Production is from Mississippian at 4858-81 feet.

Property Deals: The advance of property values arising through recent purchases by majors has not discouraged prospective buyers. Several important deals are pending, with Gulf Oil Corporation credited with having contracted for another developed lease in the Ellenburger sector of the K-M-A field.

Jack County: Continental Oil Company's Weir 1, scheduled 6000-foot wildcat 6 miles northwest of Jacksboro, was drilling at 2890 feet after recovering 540 feet of oil-cut mud and 480 feet of salt water from sand at 2327-51 feet. This shallow zone will receive further testing.

Cooke County: Development of prolific multi-pay wells on the east flank of the Walnut Bend field has stimulated interest in the general area, and exploration of nearby prospects will follow. McElreath-Suggett and Seitz-Comegys & Seitz contracted to drill McGeorge 1, Block 64, Fannin County School Lands, to 6000 feet. It is on a 650-acre block, and more than a mile southeast of the field.

Plymouth Buys Lease In Olson Pool Area

Plymouth Oil Company, developer of the first important oil field in West Texas through the Big Lake Oil Company, a subsidiary, paid $330,000 cash and notes for John I. and P. D. Moore and Olson Oil Company's leases on 5200 acres within and near the Olson pool, Crockett County, with 2 pumpers and a third well awaiting completion. The partnership will be carried for a perpetual over-riding royalty. The completed wells are 1½ miles apart, and possibly involve separate pools since they produce from different zones in the Permian.

East Texas

Glen Rose Shows Oil In Woodbine District

Bert Weekley et al's Strother 1-A, north offset to the single oil producer in the Barron-Groesbeck 6-well Pettit area, Limestone County, provided a surprise development in showing for an oil producer in the Upper Glen Rose, which has not heretofore produced in the Woodbine belt. Strother 1-A logged saturation at two levels in Upper Glen Rose, with best porosity at 4770-4805 feet, and also at 5684-5742 feet in Pettit, topped at 5680 feet with elevation of 457 feet. Five-inch pipe was cemented at 5761 feet, 7 feet off bottom, and when perforated with 74 shots at 4570-95 feet, the well responded to swabbing test with 30-32 gravity black oil flow by heads along with slugs of rotary fluid. Cement had failed to fill annular space opposite the upper pay, making it necessary to squeeze and re-perforate before a decisive test of the zone can be made. Fair to good shows of oil were logged by the five gassers and shut-in oil well in drilling the Upper Glen Rose to indicate possibility of a large area being productive. Strother 1-A entered Georgetown at 3468 ft, and anhydrite at 5153-63 feet. The Paluxy sand is almost shaled out.

Franklin County: Tide Water Associated-Seaboard Oil Company's Bacon 1, which indicated gas-distillate production in Rodessa at 7279-7304 feet, showed water in samples from Lower Rodessa and was coring at 7890 feet. It is to be drilled 300 feet into Travis Peak, and if the later is barren, pipe will be set to try for completion in Rodessa. This prospect is 4 miles north of Scroggins, and 8 miles northeast of Pittsburg 5-well Travis Peak pool.

Paluxy Wildcats: Royal Petroleum Corporation's Key 1, William Willis Survey, 2 miles southeast of Wills Point, Van Zandt County, attracted attention through having logged oil odor and stain in coring to 5785 feet in Paluxy, topped at 5695 feet with elevation of 506 feet. This wildcat used oil to loosen stuck stem while in top of the Paluxy, and some of the formation may have been contaminated with input oil. In Wood County, Bobby Manziel et al's Bailey-Shell 1, 5 miles southeast of Coke field, was coring for top of Paluxy at 6210 feet. Stanolind Oil & Gas Company's Tilson 1, Campbell area, Hunt County, drilling sandy-shale 4435 feet, possibly in Paluxy, with short section of Georgetown due to cutting fault. In Rains County, American Liberty Oil Company's Republic 1, Henry Howell Survey, drilling shale and lime 6070 feet, having entered Georgetown at 5122 feet, 74 feet low to 8482-foot failure situated 1½ miles to southeast. In Upshur County, Three C's Oil & Gas Company's Blount 1, John Trimble Survey, drilling 4615 feet in Georgetown, topped at 4585 feet with elevation of 438 feet.

Paluxy Starts: Wood County was assigned two wildcats, including F. R.

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Jackson and Roy L. Fisher et al's McCarley 1, center of e½ of north 40 acres of 150-acre tract, Hazard Anderson Survey A-9, being 1¼ miles west of Oak Grove on acreage contributed by Danciger Oil & Refineries, Inc., from its 3900-acre block for a test. Murray C. Sells et al's Morgan 1, southeast corner of 82½-acre lease, Harvey Hall Survey, about equal distance southwest of Coke field and north of Quitman field. In Franklin County, L. A. Grelling et al's Stanley 1, W. B. Jordan Survey is a mile west of Lake Franklin. W. B. Hinton et al's Wilson 1, T. C. Ry. Survey No. 44, will explore faulted structure to east of Talco field and in Titus County. In Northeastern Van Zandt County, Delta Drilling Company has taken over Beckett and Torrans' Smith 1, S. L. Flowers Survey, 4 miles northwest of Grand Saline. Majors are bidding for protection acreage.

Southwest Texas

Second Producer Completed In New Hobson Field

Drilling and development has reached a high peak in the northwest portion of Karnes County with considerable interest being shown in development in surrounding acreage in Bee and DeWitt counties. The lease and royalty trading was set off by recent discoveries in the area in the Wilcox and Reklaw sand sections. New development is in store for Bee County, especially since production was discovered in the Mineral area. Wildcatting also is on the increase, with numerous tests being planned for acreage surrounding older structures or salt domes.

Karnes County: Seaboard Oil Company has completed its second producer in the recently discovered Hobson field. Fertsch 1, west of the discovery, was perforated at 4021-24 feet and flowed 210 barrels of oil daily through 5/32-inch choke. Total depth is 4032 feet after topping pay section at 4015 feet. It is believed this well is as good if not better than the discovery. Operators have made location for Pluezkhan 1 with drilling due to start immediately.

Phillips Petroleum Company has made location for a second well in the Hondo Creek area, Behman 1, in lot 12 of T. J. Devine subdivision of Carlos Martinez survey. The company recently opened production in the area.

Bee County: New development is scheduled in the north portion of this county based partially on discovery of production at Mineral by Dirks Brothers. Rodney DeLange and W. Earl Rowe of San Antonio are preparing to drill Driscoll Ranch 1, a wildcat projected to 5500 feet, in Thomas Banuelos survey. Dirks Brothers are preparing to drill a test in the Plummer.

At South Caesar in Bee County, Seaboard Oil Company is completing its extension well on the northwest flank with Slick 2 topping sand at 6515 feet and drilling to 6588 feet. The well was tested through 3/32-inch choke with 825 pounds pressure on tubing. The company is moving rig to drill Sparkman 1, in Thomas Powell survey, southwest of production.

Jim Wells County: M. M. Miller & Sons have completed a major south-

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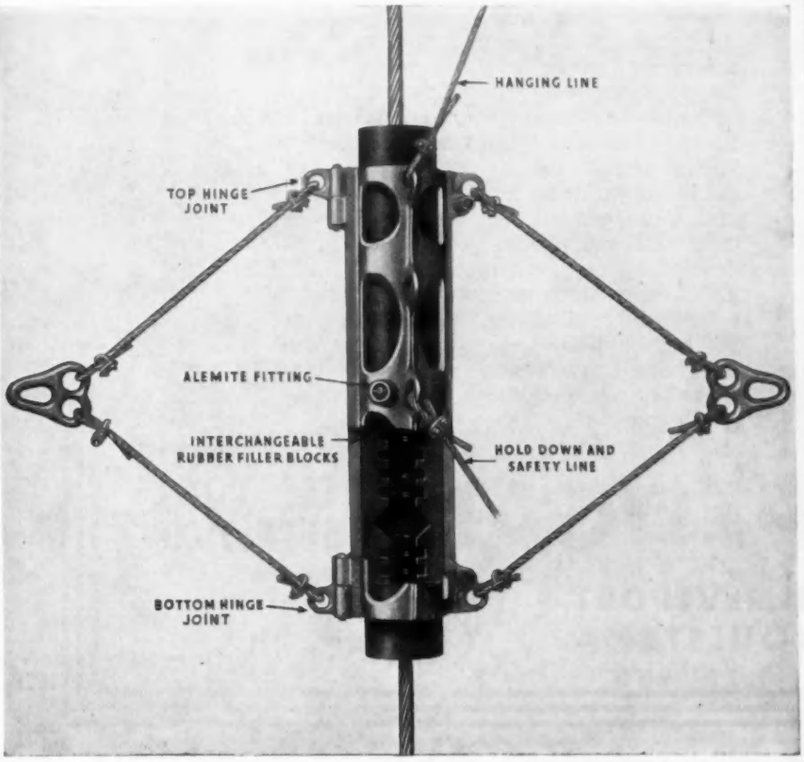

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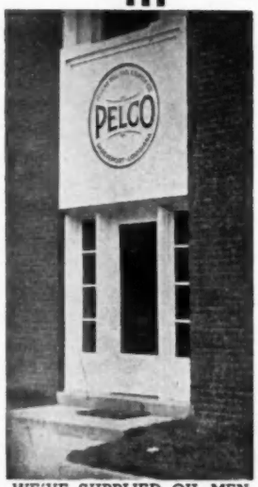

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west extension to the Gallagher field with Gallagher 1-B flowing 92 barrels of 39.7-gravity oil daily through ⅛-inch choke. The well was completed 54 feet higher in the hole than the discovery with pay sand being topped at 5135 feet and perforations made at 5135-45 feet. Total depth is 5259 feet with 5½-inch casing set to 5180 feet.

Robert W. O'Meara of Shreveport has spudded Dorris 1, west outpost at Gallagher. It is 1400 feet west of Gallagher 1, the discovery.

Victoria County: Arkansas Fuel Oil Company is preparing to drill a 5600-foot wildcat in Siedeck survey, northeast part of county. Rowan & Hope are rigging Ragsdale 1, a 4600-foot test five miles south of Inez.

Texas Gulf Coast

Katy Area to Get More Drilling for Oil Production

Drilling and production activity continues to show a slight increase with the Katy area of Harris and Waller counties dominating the development spotlight. More deep drilling in the Lake Creek area of Montgomery County is in store with two wells staked. A Wilcox wildcat in Colorado County also is holding some interest since operators recovered gas on a drill-stem test in the Cockfield.

Katy: Humble Oil & Refining Company has staked another wildcat east of the Katy field with a contract depth of 8000 feet. Cook 1, 3½ miles northeast of Katy townsite, is on a 159-acre tract in H&TC 61. There has been a sharp increase in interest in development on the north and east flanks of the field since Stanolind Oil & Gas Company completed Pattison 1 as the first oil producer in the field. Several other operations have been staked, mainly projected to test the oil sands instead of the gas-distillate horizons that produce in the field proper.

Humble is making further flow tests on Hebert 1, wildcat 4000 feet east of Stanolind's Pattison 1. Drilled to 7185 feet, casing was perforated at 7130-35 feet, but these holes have been squeezed off for further testing.

Montgomery County: Stanolind has entered development in Lake Creek field, where Superior Oil Company has been the lone operator. Stanolind will drill two 11,850-foot tests. Williams 1 on a 239-acre tract in Archibald Hodge survey, northeast side of the field which produces from the Wilcox sand, and South Texas Development 1 on an 800-acre tract in M. R. Goheen survey. The latter location is on the east side of the field.

Colorado County: Magnolia Petroleum is drilling around 6987 feet in Anderson 1, projected Wilcox test two miles southwest of Chesterville, after recovering gas on drill-stem test at 6482-85 feet with 400 pounds working pressure. The test was made in the Cockfield, although the well is scheduled to drill to 11,000 feet or deeper.

Fort Bend County: Stanolind Oil & Gas has completed a half-mile north extension to the Clodine field with Cinco Ranch 1 flowing 86 barrels of 42-gravity oil daily through 3/32-inch choke. Perforations were made at 7497-98 feet after drilling to 7502 feet and setting 5½-inch casing on bottom.

Louisiana Gulf Coast

Three Wildcats Showing For Oil Field Openers

One new field is definitely assured while a second is in the offing, and a third wildcat has set pipe before drilling deeper. Thus, activity in the coastal sector is showing a definite pick-up with these wildcats showing for field openers. The test creating most interest is on the Baer prospect of Beauregard Parish. This area, long on the "suspicious" list for possible oil production, is believed to be a large structure. Acadia Parish also is drawing its share of interest with a wildcat on the Egan prospect showing, and with operators reported setting casing to make a flow test.

Beauregard Parish: General Crude Oil Company is making a second production test on Baldwin 1, wildcat that is opening production on the Baer prospect. Casing was perforated at 6512-25 feet and flowed 15 barrels of fluid hourly through ¼-inch choke with 30 percent of the flow being salt water. New holes were due to be made at 6510-20 feet in attempt to shut off the water. The production is coming from the Frio sand. Hole is bottomed at 9412 feet with 5½-inch casing set at 6600 feet.

Acadia Parish: Sun Oil Company is preparing to set 7-inch casing to make a production test in Daily 1, wildcat on Egan prospect. The company previously set protection pipe to 8767 feet, with the hole bottomed at 10,871 feet. The best shows were reported in what is known as the Hackberry sand series, although detailed information has not been released. The well is located in Section 31-9s-1w, seven miles west of Crowley.

Jeff Davis Parish: Deep sands on the south flank of the Roanoke field will be tested with Falcon-Seaboard Drilling Company and Barnsdall Oil Company preparing to drill Rycade 1, Section 13-9s-4w, to test sands in the Hackberry that produce on the northwest flank.

Evangeline Parish: Humble Oil & Refining Company will test the Wilcox in Ortego 1, Section 2-4s-1w, at Pine Prairie, and may be the deepest test yet drilled on the southeast flank of the dome. The well is now drilling below 10,114 feet. The field produces from the Cockfield and Sparta sections.

Wildcat: Continental Oil Company is preparing to drill a 12,500-foot wildcat four miles northwest of Thornwell discovery in Jeff Davis Parish. It is Benoit 1, C NE SW 25-11s-5w.

West Baton Rouge Parish: Amerada Petroleum Corporation has set 5½-inch pipe to 9574 feet in Nelson 1, wildcat in Beaulieu area. Electrical survey was run to total depth of 9575 feet before pipe was set.

A. E. WARNER, West Texas district warehouseman of The Texas Company, was recently presented with a gold watch in recognition of 30 years service. Warner began his service as office boy in the Houston offices and rose from that position to scout before volunteering in the Army in the first World War. During that period he was attached to the air force at Aberdeen testing grounds. After the war, he returned to materials department and has served that branch since, going through the Ranger boom, transferring to Wink, then to Midland in 1939.

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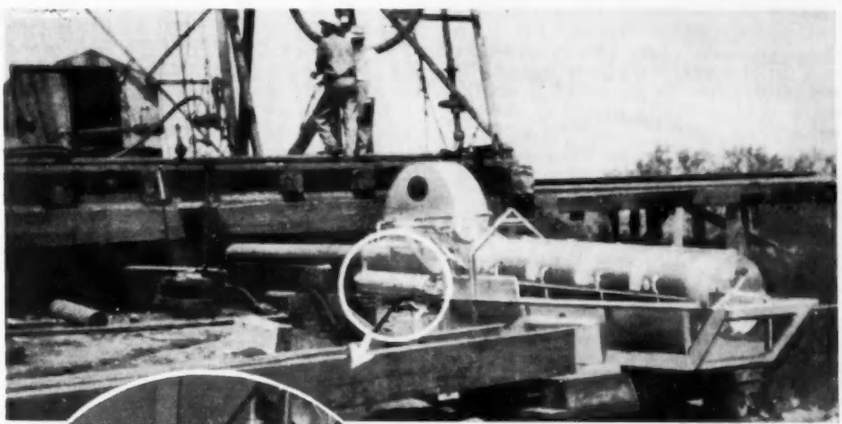

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California

Drilling Volume Twice Rate of a Year Ago

Evidence of a pickup in California drilling appeared this week in the form of increased number of starts on new wells, another gain in monthly location figures and highest record for the year in reported number of active drilling wells.

Total of 1943 locations at March 27 had reached 327 as against 156 at the same date last year. This would point to a drilling pace for the immediate future more than twice as great as that at the corresponding period of the preceding year.

In fact there is some concern among operators and drilling contractors over the possibility that the drilling pace may be stepped up so much and so fast that really serious shortages in equipment and crew personnel will be developed.

So far the great number of new wells announced represents a well-balanced list, that is, a number of important wildcats and of tries for field extensions are included with mill-run development of proved ground.

The price increase announced for California low-gravity crudes is expected to result in a rush of new drilling in the shallow, heavy-oil fields.

Fresno County: The Pure Oil Company and The Texas Company have joined forces to exploit wildcat possibilities of the Santa Rita area where the aggregate holdings of the two companies exceed 15,000 acres. An initial test, Gamboni 1, 28-10-13, is being started immediately by Pure, the indicated objective being approximately 7000 feet.

Kern County: The Texas Company's deep test seeking a new pay in the southeastern portion of Midway-Sunset field, is at 10,517 feet, drilling in a hard shale which it is hoped overlies the sand members to be examined.

Tide Water Associated Oil Company's efforts further to extend limits of Strand East pay were unsuccessful, its wildcat 32-17, in Section 17-30-26, having recovered only barren sand in the equivalent of the Stevens zone topped at 8236 feet. Drilling was stopped in gray sand at 8400 feet.

Los Angeles County: Shell Oil Company's sound-proof-noise-proof wildcat to test deep possibilities of substerranean Los Angeles, La Verne Comm. 1, has overcome a series of delaying small drilling mishaps and is making hole near 6500 feet. The primary objective of this well being to obtain geological data it is being carefully logged all the way and is to be taken to 9000 feet no matter what formations are encountered.

Orange County: Signal Oil & Gas Company's wildcat Irvine Beach 1, 6-7-9, got quick results in a test of an area on Balboa Bay bluffs. The sands sought were not present and at 1900 feet the hole was announced for abandonment.

R. H. KNIPPING has become associated with Power Specialty Company, Houston, in charge of the San Antonio, Austin, and Corpus Christi territory.

Michigan

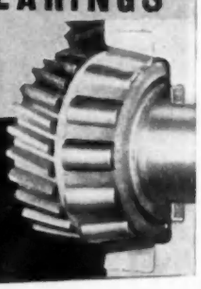
Aetna-Prosper Pool Gets First Failure

Despite apparent wide non-conformities on the producing horizon, an area a mile east and west and a half mile north and south has been proven productive in the Aetna-Prosper pool of Missaukee County. First dry hole for the field was reported, however, with Pure Oil Company's Jenema 1, S½ SE SE 27-22n-6w, farthest west test, abandoning at 3874 feet in water zone. Gordon Oil Company's Kornoely 1, S½ NE SW 26-22n-6w, first completion north of producers, flowed up to 147 barrels per hour on test and was rated at 2100 barrels. Production now has been established in an area of only 240 acres in a 34-foot closure.

Missaukee County: Pure Oil Company temporarily abandoned Nix 1, S½ NW NW 11-23n-5w, 1320 feet north of the play opener, after missing a pay in the Dundee. Drilling was halted at 3284 feet with 2000 feet of black water. The company may make a Richfield or 4500-foot test later.

DAN J. HARRISON, organizer of Harrison Oil Company, which was recently sold to Socony-Vacuum Oil Company, has formed Indiola Oil Company with headquarters at Houston. The new company has capital stock of $1,000,000 with $500,000 paid in. Harrison subscribed to 50 percent, while Ethel H. Harrison and W. M. Gaston hold 25 percent each.

TIMKEN ROLLER BEARINGS
in a SINGLE CYLINDER ENGINE?



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Rocky Mountain Area

Two Important Oil Discoveries in Wyoming

Wyoming operators came through with two important discoveries, one a new light-oil discovery at Steamboat Butte, the other deep black oil. Meanwhile, an important deep test was spotted for Tensleep exploration in the South Baxter Basin field.

Steamboat Butte: British-American Oil Producing Company's Tribal 1-E, NE NW NW 5-3n-1w, Steamboat Butte structure, Fremont County, Wyoming, showed for 60 barrels hourly on drill-stem test of Sundance sand. With tester open one hour from 5093-5109 feet, drill stem filled with 2630 feet of 30 API oil, sulphur free, and 170 feet of oil-cut mud. An additional 10 feet of core to 5119 feet, recovered 4 feet of which 2 feet was highly saturated and 2 feet dry. Seven-inch casing is set at 5091 feet with Sundance topped at 5083 feet.

The discovery is three miles northwest of the deep Tensleep development on the Pilot Butte structure, on which Steamboat is a small high on the northwest end of the uplift. Steamboat has an apparent independent closure of 350 feet, while Pilot Butte, as a whole, has a closure of 1000 feet. Water is encountered in the Sundance at Pilot Butte, which runs 1000 feet higher than at Steamboat. Original objective of the Steamboat Butte wildcat was the Tensleep sand, which was proved for heavy-oil production a year ago at Pilot, and appears assured for production at Steamboat. The well is located on the upthrow side of a fault which cuts the axis of the small structure.

Oregon Basin: Yale Petroleum Company completed Hancock 4, NW NE NE 5-50n-100w, on the south dome of the Oregon Basin field, Park County, Wyoming, pumping 60 barrels per hour from Madison lime saturation at 4155-4300 feet. (See Wyoming field completions for complete sand record.) Hole bottoms at 4652 feet in the Deadwood formation. Gravity of the oil is 18 API. Deepest test, heretofore, drilled at Oregon Basin is Cody Petroleum Company's Klindt 2, SE NE NE 7-51n-100w, which is believed to have reached the Amsden and had a hole full of oil from lime saturation at 4150-4175 feet, but subsequently plugged back to complete in Embar at 3495 feet. Oregon Basin structure is 11 miles long and 6 miles wide. It was the most active of Wyoming fields in 1942 with a total of 34 completions, all substantial oil wells in the Embar formation.

South Baxter: Mountain Fuel Supply Company is rigging-up rotary for Unit 1, NE SW NE 21-16n-104w, for the untested Tensleep sand, South Baxter Basin field, Sweetwater County, Wyoming. This well is considered one of the most important tests under way in the exploration for new reserves in the Rocky Mountain division in view of the several recent Tensleep developments, particularly in the Lost Soldier-Wertz fields, and the considerable area embraced in the Baxter Basin uplift. Approximately 9750 acres have been proved for gas at North, South and Middle Baxter Basins with Sundance, deepest drilled, producing gas from around 3400 feet. Tensleep is expected at 7000 feet.

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See page 2450 Composite Catalog

WEB WILSON OIL TOOLS

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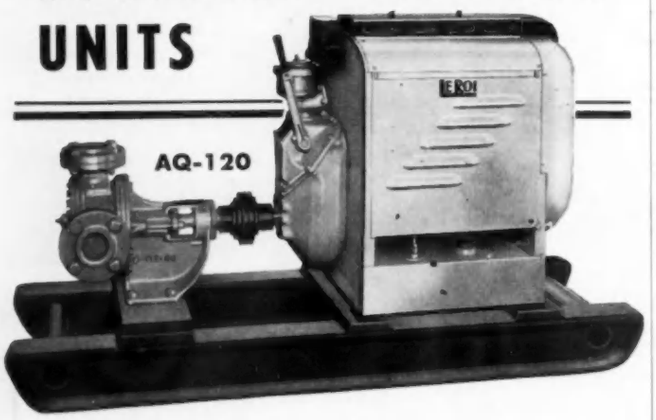

The AQ-120 unit is a Viking Rotary Pump driven by a Le Roi Engine. Capacity is 128 barrels per hour against 50 pounds pressure.

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INTERPRETATIONS BY SECOND DERIVATIVE ANALYSIS

KLAUS EXPLORATION COMPANY

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United States Well Completions

CALIFORNIA

Fresno County—Coalinga Old Field: Shell's 176-26, ne se 26-19-15, pump 52 bbls 19.9-gr, 181 ft perf 3564 ft, black shale 3259 ft, td 3567 ft.

Standard's 23-35A, se se 35-19-15, pump 90 bbls 20.2-gr, perf 3333-3443 ft, base black shale 2930 ft, A 2797 ft, B 2990 ft, C 3198 ft, D 3304 ft, td 3470 ft.

Standard's 112-35A, se se 35-19-15, pump 56 bbls 20.5-gr, A 2482 ft, B 2678 ft, C 2892 ft, D 3002 ft, E 3034 ft, F 3055 ft, G 3097 ft, H 3160 ft, td 3175 ft.

Standard's 62-3C, ne se 3-20-15, pump 128 bbls 19.3-gr, 184 ft perf 3547 ft, A 2750 ft, B 2950 ft, D 3305 ft, E 3363 ft, F 3378 ft, G 3427 ft, H 3529 ft, td 3550 ft.

Fresno County—Riverdale: Amerada's Brum 56-15, nw se 15-17-19, flow 212 bbls 33.8-gr, 10/64-in, 650-100 lbs, perfs 6650-6640, 6610-6585, 6580-6570, 6550-6560 ft, McLure 5224 ft, Temblor 5500 ft, td 6900 ft.

Kern County — Belridge South: General's Belridge 19-2, se ne 2-29-21, pump 58 bbls 14.3-gr, perfs 635-741, 752-857 ft, td 865 ft.

General's 40-12, sw ne 12-29-21, pump 41 bbls 14.6-gr, 19 water, 163 ft, perf 1088 ft, td 1090 ft.

Ohio's Hopkins Fee 16, nw ne 429-21, pump 1 bbl 13.6-gr oil, 9 water 129 ft, perf 774 ft, td 815 ft.

Kern County—Buena Vista Hills: North American Oil Consolidated's 6, se ne 2-32-24, pump 45 bbls 27-gr, 146 ft perf 3860 ft, Scalez 3764 ft, oil sand 3847 ft, td 3852 ft.

Union's McLeod 15, se ne 34-31-23, pump 79 bbls 21.8-gr oil, 28 water, perf 2973-2923, 3210-3176, 3292-3228, 3332-3312, 3537-3508, 3576-3563 ft, Mulina sand 2935 ft, gusher zone 3185 ft, Calitroleum sand 3510 ft, td 3580 ft.

Kern County—Edison: Jergins Oil Co.'s Jergins-Texas Fee 23, nw ne 23-30-29, pump 150 bbls 21.6-gr oil, 14 water, 128 ft perf 1885 ft, schist 2043 ft, 1st oil sand 1533 ft, Chanac 1919 ft, Santa Margarita 1969 ft, td 2056 ft, pd 1913 ft.

Kern County—Lost Hills: Universal Consolidated's 52, ne nw 30-26-21, pump 28 bbls 15.4-gr oil, 15 water, 500 ft perf 1624 ft, top sand 1109 ft, td 1624 ft.

Kern County — Midway-Sunset: Chanslor Canfield Midway Oil Co.'s 52-9, se sw 9-32-23, pump no est, perf 1520-1510, 1495-1485, 1295-1280 ft, 1st oil sand 1280-1295 ft, 2nd oil sand 1485-1500 ft, 3rd oil sand 1509-1519 'ft, td 1600 ft.

Chanslor Canfield's 55-9, nw ne 9-32-23, pump 12 bbls 19.2-gr oil, 10 water, 173 ft perf 2877 ft, Kinsey 2646 ft, Wilhelm 2739 ft, Gusher 2811 ft, Calitroleum 3191 ft, td 3228 ft, pd 2878 ft.

Standard's 17-19D, sw se 19-32-24, flow 158 bbls 24.1-gr, 12/64-in, 200/0 lbs, 150 ft 5½-in incl perfs 2598, Reef Ridge 2720 ft, td 3438 ft, pd 2600 ft.

Kern County—Mount Poso: Ring Oil Co.'s Bowles 15, ne se 29-26-28, pump 95 bbls 16-gr, 25 ft perf 1764 ft, Vedder 1744 ft, td 1764 ft.

Ring Oil Co.'s Bowles 17, nw sw 29-26-28, pump 100 bbls 16.5-gr, 25 ft perf 1723 ft, Vedder 1700 ft, td 1791 ft.

Ring Oil Co.'s Bowles 18, nw sw 29-26-28, pump 100 bbls 16-gr, 25 ft perf 1691 ft, Vedder 1666 ft, td 1691 ft.

Kern County—Poso Creek-Premier: Standard's 5-18, se se 5-28-27 pump 13 bbls oil, 12 water, 6⅝-in 2798 ft, td 2800 ft.

Kern County — Round Mountain: Shell's Caldwell 25, nw sw 7-28-29, pump 110 bbls oil, 16 water, 25 ft perf 2012 ft, td 2012 ft.

Kern County — Williams Antelope Hills: Shell's Williams 56-6, se nw 6-28-20, pump 1 bbl oil 7 water, 57 ft perf 2240 ft, IB zones 2175 ft, base IB zone 2299 ft, td 2307 ft, pd 2240 ft.

Los Angeles County—Brea Olinda: Union's Stearns 75, nw se 7-3-9, pump 196 bbls gross, 855 ft, perf 3158 ft, td 6425 ft, pd 3160 ft.

Los Angeles County—Montebello: Kern Oil Co.'s Monterey 45, 450 ely along c/l Lincoln Ave fr c/l Maple Ave then 1121 nly at ra, pump 60 bbls 19.6-gr oil, 25 water, 194 ft perf 3295 ft, td 3297 ft.

Standard's Baldwin 107, ne ne 2-2-12, pump 91 bbls 14.2-gr oil, 53 water, 332 ft perf 2844 ft, td 2845 ft.

Los Angeles County—Redonodo-Torrance: Wood-Callahan Oil Co.'s Dominguez Estates 4, swc Dominguez Estates, pump 35 bbls, 7-in csg 3234 ft, Poker Chip shale 3216 ft, td 3654 ft.

Los Angeles County—Wilmington: (Old well recompleted) Union Pacific's 62, 839 sly along c/l Ford fr c/l Anaheim thence 275 ft ely at 90 degrees, pump no est, old depth 3455 redrilled to 3455 ft.

Orange County—Huntington Beach: S. W. Exploration Co.'s State 50, 319 ft n 4817 w of c/ls 23rd & Ocean, pump 355 bbls 21.6-gr, 518 ft perf 4915 ft, td 4915 ft.

Standard's A-41, 1250 ft nwly c/l Wesley extdd fr c/ls 23rd St thence 250 ft swly at r/a, pump 165 bbls 16.3-gr, 379 ft perf 3950 ft, td 3950 ft.

Standard's PE 24, 125 ft s & 2091 ft w c/ls 23rd & Ocean, pump 26 bbls oil, 9 bbls water, 274 ft perf 3295 ft, original depth 3820 ft redrilled and deepened to 4200 ft.

CALIFORNIA WILDCATS

Kern County—Failure: Shell's KCL Posuncula B 84-27, 27-30-26, Posuncula area, Stevens zone 8007 ft, abnd 8370 ft.

Kern County—Failure: Iseminger Bros. 1, 2-28-28, Round Mountain area, Vedder 2070 ft, abnd 2113 ft.

COLORADO

Boulder County—Boulder: Everett Swanson's Johnson 1, se 15-2n-70w, abnd 2821 ft.

Rio Blanco County—Wilson Creek: Texas and California's Unit 12, nw ne sw 34-3n-94w, rotary, flow 320 bbls, 5/16-in, td 6600 ft, Morrison sand.

ILLINOIS

Clay County: F. Jablonski's Burge 1, sw sw sw 11-5n-5e, abnd 2384 ft.

Fayette County: Carter's Alsop 4, sw se sw 3-8n-3e, Weller 1523-35 ft, 96 bbls, 1535 ft.

Franklin County: E. S. Adkins' Orient D-4, ne ne se 13-7s-2e, abnd 2654 ft.

Gallatin County: Globe et al's Pilot-Hish Comm. 1, se se se 16-8s-9e, Cyp sand 2496-2523 ft, 46 bbls, 2523 ft.

Hamilton County: Texas Co.'s Wilson 4, se se se 28-6s-6e, abnd 3175 ft.

Gulf's C. Harrawood 1, nw ne nw 19-6s-7e, abnd 3088 ft.

Menhall and National Petroleum Co.'s Ray Harrawood 2, se ne nw 19-6s-7e, Cyp 2751-72 ft, 134 bbls, 2800 ft.

Jefferson County: Magnolia's Reid-Grissom 1, se ne se 26-2s-1e, Ben 2014-24 ft, 49 bbls, 2024 ft.

Gulf's Dunning 1, c se nw 36-2s-4e, McCl 3021 ft, 356 bbls, 3040 ft.

Gulf's Osborne 1, c ne nw 36-2s-4e, abnd 3120 ft.

Texas Co.'s Smith 2, ne ne ne 33-3s-3e, A.V. 2737-48 ft, 139 bbls, 2762 ft.

Nash Redwine's Rudolph 5, sw se nw 34-3s-3e, A.V. 2724-35 ft, 143 bbls, 2740 ft.

Lawrence County: S. W. Mitchell's Bartholemy 2, c s½ sw ne 26-2n-12w, abnd 1436 ft.

C. F. Ross' Clifton Logue 1, sw ne se 26-2n-12w, abnd 1385 ft.

Washington County: Magnolia's Gill Est. 10, sw nw nw 26-3s-3w, Ben 1265-1270 ft, 57 bbls, 1289 ft.

Wayne County: Pure's Hosselton D-1, c w½ ne se 21-2n-8e, McCl 3002-06 ft, 3056-62 ft, 136 bbls, 3065 ft.

Pure's A. Riggs A-2, c nw sw se 21-2n-8e, McCl 3042-55 ft, 10 bbls, 3055 ft.

Olson Oil Co.'s Shaffer 1, c w½ sw sw 14-1s-6e, McCl 3161-64 ft, and 3184-92 ft, pb 3170 ft, 174 bbls, 3198 ft.

White County: Jarvis & Marcell's Gardner 3 c n½ nw sw n½ 31-4s-11e, T. S. 2300-41 ft, 125 bbls, 2342 ft.

Jarvis & Marcell's C. T. Spencer 2, se se sw 31-4s-11e, T. S. 2324-53 ft, 375 bbls, 2353 ft.

Superior's Ford et al 24, ne sw sw 4-5s-14w, Walts 2169-93 ft, 51 bbls, 2200 ft.

ILLINOIS WILDCAT

Jefferson County—Failure: Byars & Ellison's Jefferson 2, ne se ne 31-3s-2e, abnd 2769 ft.

Wabash County—Failure: C. E. Skiles' Shaw 1, nw nw nw 27-1n-13w, abnd 2798 ft.

Wayne County—Failure: Deep Rock's J. Anderson 1, c sw nw 35-2s-5e, abnd 3354 ft.

White County — Failure: First Nat'l Pet. Trust's M. Schieber 1, sw se se 6-6s-11e, abnd 3056 ft.

INDIANA

Gibson County: Carrol Oil Co.'s Crecelius 4, se nw se 36-1s-10w, abnd 1501 ft.

Jay County: W. L. Hartley's Fee 1, e½ ne ne 36-24n-12e, 3 bbls, 1023 ft.

Posey County: Sun's Greathouse D-1, nw se se 30-4s-13w, abnd 2974 ft.

Basin Drlg. Co. et al's Oakland City 2, nw se nw 16-8s-14w, abnd 2690 ft.

Spencer County: Dameron, Gary & Savage's Jones 1, nw ne sw 34-7s-7w, abnd 1328 ft.

Vanderburg County: Superior's Nurrenburn 3, sw nw sw 32-6s-11w, Walters 1753-59 ft, 50 bbls, 1760 ft.

INDIANA WILDCAT

Posey County—Failure: Carter's Schneider 1, c sw sw 34-7s-14w, abnd 2806 ft.

KANSAS

Barton County—W. Kraft-Prusa: Armer & Vernon's Hoffman 3, ne ne sw 18-16s-11w, Arb 3323 ft, 1500 gal acid, potential 1120 bbls, 3336 ft.

Black-Marshall's Dolechek 2, ne ne se 24-16s-12w, Arb 3351 ft, 1100 gal acid, pump 64 bbls oil, 16 wtr, 3367 ft.

Branine & Goering et al's Radenburg 1, ne ne ne 17-17s-11w, Arb 3303 ft, 500 gal acid, pump 531 bbls, 3305 ft.

Barton County—Merten: Transwestern's Seeber 1, nw ne nw 10-19s-15w, Basal sand 3529 ft, shot 20 qts, 1,186,000 dry gas, abnd 3582 ft.

Butler County—Eldorado: Allbe Oil Co.'s

Wells Completed in the United States in Week Ended April 3, 1943

Data preliminary and subject to revision. Revised and more complete data on all completions shown in monthly summary of drilling, published in second issue of each month. More detailed data on wildcats published in third issue of each month.

State or District	FIELD COMPLETIONS						WILDCAT COMPLETIONS				ALL COMPLETIONS			
	New Wells					Old Wells Deepened							Cumulative	
	*Oil	Gas	†Input	Dry	Total		*Oil	Gas	Dry	Total	This Week	Last Week	This Year	Last Year
Alabama														2
Arkansas												6	39	53
California	28				28	1			2	2	31	26	345	231
Colorado	1			1	2						2		5	4
Georgia														1
Illinois	14			7	21				4	4	25	37	501	509
Indiana	2			4	6				1	1	7	6	80	106
Kansas	18		1	6	25				7	7	32	14	374	434
Kentucky	8			1	9						9	6	75	45
Louisiana	3			1	4						4	2	135	303
North Louisiana													52	
South Louisiana	3			1	4						4	2	83	
Michigan	3			3	6	2			3	3	11	8	114	187
Mississippi													6	46
Missouri													3	9
Montana	11	3		3	17				1	1	18		56	40
Nebraska														14
New Mexico	4			1	5	1			2	2	8	6	68	118
New York	13		5		18						18	18	296	346
Ohio	2	7		7	16						16	13	230	342
Oklahoma	11	2	2	6	21	1	3	1	7	11	33	16	356	470
Pennsylvania	38	3			41						41	41	660	977
Tennessee													1	3
Texas	32	1		8	41		2		11	13	54	66	949	2,024
E. T. Border Co's													5	
E. Texas. Field													2	
Rest of E. Texas	3				3				1	1	4	3	51	
North Texas	4			3	7		2			2	9	21	220	
West Central	2			5	7				1	1	8	3	78	
West Texas	14				14				1	1	15	16	218	
Panhandle												4	63	
Upper Coast	2				2				2	2	4	6	64	
Lower Coast	5				5						5	7	131	
Southwest	2	1			3				5	5	8	5	97	
South Central									1	1	1	1	20	
West Virginia	3	9		1	13						13	11	157	201
Wyoming	2			1	3		1		1	2	5		35	24
Total U. S.	193	25	8	50	276	5	6	1	39	46	327	276	4,485	6,489

* Includes distillate wells. † Includes salt water disposal wells.

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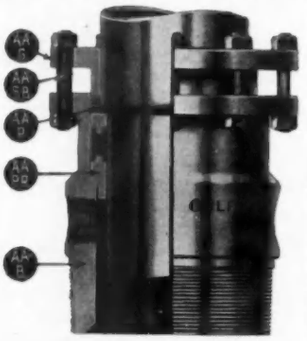

SEE GULFCO 20 PAGE SECTION COMPOSITE CATALOG

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(Mid-Continent Region)

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Dempsey 14, ne nw sw 11-26s-4e, Wx 2349 ft, 500 gal acid, pb to 2401 ft, pump 6 bbls oil, 60 wtr, abnd 2405 ft.

Ellis County — Bemis-Shutts: Texas Co.'s Bemis B-2, sw sw nw 15-11s-17w, salt wtr disposal well, 8151 ft.

Ellsworth County—W. Stoltenberg: N. Appleman, Alpine et al's Jezek 1, c n½ ne se 7-16s-10w, Arb 3330 ft, 1050 bbls, 3341 ft.

Graham County — Morel: Cities Service's Morel B-3, nw ne ne 22-9s-21w, Arb 3755 ft, 2944 bbls, 3758 ft.

Haskell County—Hugoton: United Prod.'s Mossbarger 1, c 23-29s-34w, abnd 670 ft.

Jefferson County—McLouth: Lofquist's McLeod 1, nw se se 5-10s-20e, Miss 1532 ft, pay 1656 ft, pump 50 bbls, 1660 ft.

Marion County—Lost Springs Area: Sharon Drlg. Co.'s Rindt 1, c n½ ne ne 3-18s-4e, Miss lime 2375 ft, abnd 2400 ft.

McPherson County — Crowthers: Westgate-Greenland's Crowther 3, c s½ se nw 26-17s-1w, Miss chat 2818 ft, abnd 2864 ft.

McPherson County—SW Lindsborg: Auto-Ordnance's Bean 2, c w½ se nw 36-17s-4w, Viola 3399 ft, 3300 gal acid, pump 932 bbls oil & salt wtr, 3406 ft.

Pratt County—Iuka: Skelly's Beck A-4, sw ne nw 7-27s-12w, Simp sand 4228-31 ft, 5000 gal acid, shot 30 qts, pb to 4248 ft, pump 154 bbls, td 4251 ft.

Reno County—Zenith: Magnolia's Darr 3, c se nw 6-24s-10w, Viola 3700 ft, 3000 gal acid, 1556 bbls, 3718 ft.

Rice County—Smyres: Shade & Barry's Anderson 2, ne nw sw 25-19s-6w, Miss Chat 3348 ft, pump 512 bbls, 3372 ft.

Rice County—Chase: C. H. Weaver's Robins 3, c ne ne 19-19s-9w, Arb 3256 ft, pump 500 bbls, 3266 ft.

Rice County—Keesling: Cities Service's McGlynn B-1, c se nw 16-20s-9w, Arb 3241 ft, 1000 gal acid, pump 326 bbls, 3253 ft.

Cities Service's McGlynn B-2, c sw nw 16-20s-9w, Arb 3281 ft, abnd 3314 ft.

Rice County—Wenke: Herndon Drlg. Co.'s Loula 3, c se sw 19-20s-10w, Arb 3341 ft, abnd 3351 ft.

Rooks County—Dorr: Cities Service's Crawford 1, c sw sw 16-9s-16w, Lans 3121 ft, 2000 gal acid at 3304-15 ft, pump 253 bbls, 3525 ft.

Russell County—NW Greenvale: Magnolia's Trapp 2, se ne ne 31-14s-12w, Upper Gorham 3155 ft, pump 662 bbls, 3157 ft.

Stafford County — Drach: Atlantic's Hitz B-2, c nw sw 7-22s-12w, Arb 3672 ft, 1000 gal acid, 1841 bbls, 3679 ft.

Stafford County—Zenith: Great Lakes Carbon Co.'s Johnson 1, c e½ sw ne 3-24s-11w, Viola 3691 ft, 3000 gal acid, pump 160 bbls oil 24% BS & wtr, 3735 ft.

Stafford County—Kipp Pool: Skelly & Texas Co.'s Kipp F-1, c s½ sw se 22-25s-14w, Lans 3688 ft, pay 3824-26 ft, 5000 gal acid, flow 267 bbls oil, 3,660,000 gas, 3907 ft.

KANSAS WILDCATS

Barton County—Failure: Bartlett, Crum et al's McCann-Campbell 1, c n½ nw ne 24-17s-15w, Anhy 935 ft, Howard 2832 ft, Topeka 2904 ft, Brn Ls 3178 ft, Lans 3206 ft, Arb 3461 ft, Congl 3445 ft, abnd 3511 ft.

Decatur County — Failure: Helmerich & Payne's Savage 1, ne ne ne 3-1s-27w, Anhy 2005 ft, Topeka 3154 ft, Lans 3307 ft, granite wash 3645 ft, granite 3676 ft, abnd 3680½ ft.

Ellis County—Failure: Mid-Continent et al's Fischer 1, ne ne ne 8-11s-20w, Dakota 988 ft, Anhy 1504 ft, Topeka 3105 ft, Lans-KC 3353-82 ft, Marm 3582 ft, Congl 3638 ft, Arb 3673 ft, Viola 3628 ft, Simp 3645 ft, abnd 3686 ft.

Ellsworth County—Failure: N. Appelman & Bradley Bros.' Becker 1, se se se 2-17s-9w, Lans 2907 ft, Cherty congl 3236 ft, Simp shale 3245 ft, abnd 3263 ft.

McPherson County — Failure: Auto Ordnance's Larson 1, se se nw 22-18s-4w, Lans 2497 ft, Miss 3144 ft, Viola 3609 ft, Arb 3776 ft, abnd 3815 ft.

Stafford County — Failure: Continental's James 1, se se sw 36-24s-13w, Topeka 3000 ft, Lans 3592 ft, Congl 3927 ft, Viola 4007 ft, Simp shale 4113 ft, Arb 4179 ft, abnd 4234 ft.

Falcon-Seaboard's Redetzke 1, c n½ ne ne 5-24s-14w, Anhy 895 ft, Topeka 3225 ft, Lans 3632 ft, Base KC 3889 ft, Congl 3960 ft, Simp 4065 ft, Arb 4106 ft, abnd 4150 ft.

KENTUCKY

Daviess County: J. C. Ellis and Ashby's Barrett 1, 1-N-31, abnd 955 ft.

Henderson County: Carter's Denton 1, 21-O-23, McCl 2560-70 ft, 232 bbls, 2737 ft.

M. Siegel et al's Dempewolf 3, 19-P-27, Palestine 1046-59 ft, 35 bbls, 1061 ft.

Farm Bureau's Burbank 8-A, 3-P-21, Cyp 2298-2304 ft, 200 bbls, 2304 ft.

Cherry & Kidd's Burbank 10, 4-P-21, Cyp 2288-2302 ft, 500 bbls, 2301 ft.

Trans-Tex Prod.'s Burbank A-3, 4-P-21, Cyp 2300-09 ft, 600 bbls, 2309 ft.

Gulf's Williams 4, 23-Q-21, Cyp 2296-2314 ft, 200 bbls, 2314 ft.

Gulf's Williams 5, 23-Q-21, Cyp 2292 ft, 253 bbls, 2314 ft.

Union County: Sun's Uniontown Unit 2-1, 20-P-19, Walt 1800-13 ft, 56 bbls, 1813 ft.

SOUTH LOUISIANA

Cameron Parish—East Hackberry: Union Sulphur's State-Watkins 2, 1019 ft n, 123 w s cor of "Unsurveyed Island" in 24-12s-10w, 5½-in 5160 ft, perf 5045-60 ft, flow 145 bbls, ⅛-in, td 5819 ft.

Plaquemines Parish—Quarantine Bay: Gulf's

State-Quarantine Bay 33, 3730 ft e alg nl sec 7 fr ne cor & 330 ft n at ra in 6-19s-17e, 5½-in 8359 ft, perf 8322-29 ft, flow 281 bbls, 9/64-in, td 8591 ft.

St. Charles Parish—Bayou Couba: Gulf's Delta 5, 1980 ft e, 560 n sw c 7-15s-22e, 5½-in 8440 ft, abnd 8440 ft.

St. Landry Parish — Port Barre: William Helis' Futral-McDonald 1, 5980 ft n 8 deg 30 mins e, thence 2162 ft s 81 deg 30 mins e fr sw cor 20 in 7-6s-6e, 7 in 6075 ft, perf 6464-74 ft, flow 34 bbls dist, 12/64-in, td 7310 ft.

MICHIGAN

Allegan County—Monterey: S. L. Findley's McNab 1, nw ne se 9-3n-13w, Traverse lime, dry 1779 ft.

Missaukee County — Aetna-Prosper: Gordon Oil Co.'s Kornoely 1, s½ ne sw 26-22n-6w, Dundee dolomite, flow 2100 bbls, 3837 ft.

Pure's Jenema 1, s½ se se 26-22n-6w, Dundee dolomite 3866 ft, dry 3874 ft.

Gulf's Bunning 1, s½ ne nw 35-22n-6w, Dundee dolomite, flow 156 bbls, 3827 ft.

Missaukee County—Enterprise: Pure's Nix 1, s½ nw nw 11-23n-5w, Dundee lime, dry 3824½ ft.

Osceola County—Evart: Sun's Halstead 1, n½ ne se 28-18n-8w, Dundee lime, flow 178 bbls 10 hrs, 3732 ft.

MICHIGAN WILDCATS

Allegan County—Failure: Dapar Oil Co.'s Stebbins 1, nw ne ne 3-4n-12w, dry 1748 ft.

Van Buren County—Failure: H. H. Heinig's Krause 1, c se sw 29-1s-16w, Traverse lime, dry 1036 ft.

Wexford County — Failure: Freeman Oil Co.'s Lindstrom 1, s½ sw nw 23-21n-9w, Dundee 3950 ft, dry 4121 ft.

MICHIGAN WELLS DRILLED DEEPER

Clare County—Headquarters: Pure's Thompson 1, n½ nw se 3-20n-3w, old td 5651 ft, dry 5929 ft.

Osceola County—Reed City: Ohio's Heilman 1, s½ nw se 19-18n-10w, old td 3606 ft, flow 124 bbls, 3rd Monroe pay, 3620 ft.

MONTANA

Fallon County—Cedar Creek: Montana Dakota Utilities Co.'s Unit 168, c sw 23-90n-59e, rotary, 1.4 ft gas, Judith River 1060, td 1150 ft.

Montana Dakota's Unit 170, c ne 23-8n-59e, rotary, .150 ft gas, rp 107 lbs, td 930 ft.

Montana Dakota's Unit 172, c ne ne 8-8n-59e, rotary, .175 ft gas, rp 88 lbs, Judith River 920-969 ft, td 986 ft.

Glacier County—Cut Bank: Glacier Production Co.'s Corrigeaux 5, c se nw 21-35n-5w, cable, swab 90 bbls, elev 3908 ft, Lower Cut Bank 2954-59 ft, td 2960 ft.

Glacier's Lookhoff 8, c sw ne 33-3n-5w, cable, swab 40 bbls, Lower Cut Bank, td 2948 feet.

William Hanlon's Tribal-225 1, se ne nw 25-32n-6w, cable, swab 100 bbls, elev 3752 ft, Lower Cut Bank 3132-40 ft, td 3148 ft.

Texas' Willis 5, se nw sw 20-32n-5w, cable, swab 90 bbls, Lower Cut Bank 2610-17 ft, td 2630 ft.

Trigood Oil Co.'s Tribal-229 1, se ne se 23-32n-6w, cable, abnd 2930 ft.

Trigood's Tribal-230 1, se nw sw 29-32n-5w, cable, swab 197 bbls, Lower Cut Bank, td 2835 ft.

Trigood's Tribal-230 2, se sw sw 29-32n-5w, cable, swab 198 bbls, elev 3631 ft, Lower Cut Bank 2869-75 ft, td 2908 ft.

Trigood's Tribal-231 1, se ne sw 30-32n-5w, cable, pump 100 bbls, elev 3685 ft, Lower Cut Bank, td 3012 ft.

Trigood's Tribal-232 1, se nw se 30-32n-5w, cable, pump 200 bbls, elev 3603 ft, td 2967 ft.

Toole County—Kevin: A. B. Cobb and Hardrock Oil Co.'s Govt 1, sw ne sw 17-35n-3w, cable, abnd 2111 ft.

Prevol & Shay's Waite 12, ne nw ne 24-35n-2w, cable, abnd 1579 ft.

Texas' Lind 7, nw nw nw 11-35n-2w, cable, pump 102 bbls, Ellis-Madison contact 1647 ft, td 1661 ft.

Texas' Swears 10, sw se sw 9-35n-2w, cable, pump 232 bbls, Sunburst 1385-1410 ft, Ellis-Madison contact 1617-32 ft, acid 500 gals, td 1632 ft.

Twin Fields Oil Co.'s Thompson 4, ne ne sw 28-35n-3w, cable, pump 26 bbls oil, 26 water, Ellis-Madison contact 1668-71 ft, water zone 1854-58 ft, pb 1675 ft, td 1858 ft.

MONTANA WILDCAT

Carbon County — Clarks Fork — Failure: Northern Ordnance, Inc.'s Govt. 1, c nw nw 25-9s-22e, rotary, Parkman sandstone 3750-3950 ft, abnd 4212 ft.

NEW MEXICO

Eddy County: Plains Prod. Co. et al's Jones 5, c ne ne 24-19s-31e, abnd 2614 ft.

W. S. Randall et al's Etz 3, c se sw 26-16s-30e, flow 175 bbls, 2-in, shot 160 qts 2960-3040 ft.

Superior's (Cal.) Foster 2, c nw se 17-17s-31e, flow 43 bbls, 2-in, shot 50 qts 2968-85 ft, acid 4000 gals 3040-50 and 3458-68 ft.

Lea County—Maljamar: John Cockburn et al's Miller 10-B, c nw se 25-17s-32e, flow 1032 bbls, 2-in, shot 200 qts 4115-4215 ft.

Maljamar's Mitchell 14-B, c se sw 19-17s-32e, flow 276 bbls, 2-in, natural, 3590-3615 and 3882-3900 ft, td 3922 ft.

NEW MEXICO WELL DEEPENED

Lea County—Maljamar: Barney Cockburn et al's Miller 1-B, c sw nw 23-17s-32e, otd

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NEW MEXICO WILDCATS

Lea County—Junked: Maljamar's Chessman 1, c ne ne 22-18s-32e, jkd 725 ft.

Quay County—Failure: Stanolind's Fuller 1, c ne ne 25-8n-30e, elev 4459 ft, granite 6733 ft, abnd 6747 ft.

OKLAHOMA

Caddo County—Cement: Ohio's School Land 4, nw ne se 13-5n-9w, Middle Rowe sand 4364-85 ft, salt wtr disposal, td 4581 ft.

Carter County—Tussy: J. Batson's Moore 3, ne se ne 5-1s-3w, abnd 66 ft.

Creek County—Semi-Wildcat: L. Williams' Blakemore 1, sw nw sw 11-16n-10e, Wx 2978 ft, abnd 2983 ft.

Creek County—Glenn: Gulf's Clayton 31 e½ ne se 8-17n-12e, Glenn 1517 ft, shot 270 qts, pump 20 bbls oil 3½ wtr 23 hrs, 1680 ft.

Gulf's Berryhill 36, sw se se 9-17n-12e, Glenn 1430 ft, shot 270 qts, pump 14 bbls 12 hrs, 1590 ft.

Creek County — Cushing: Sinclair Prairie's Goodin 17, ne nw se 16-17n-7e, Bartles 2623-30 ft, shot 80 qts, pump 11 bbls oil, 12 wtr, 2722 ft.

J. E. Crosbie's Bailey 4, se nw nw 12-18n-7e, Skinner 2610 ft, Bartles 2614-30 ft, shot 80 qts, flow 90 bbls, 2630 ft.

Magnolia's Jones 4, sw ne sw 36-18n-7e, Bartles 2857 ft, 200,000 cfg, 3040 ft.

Marshall County—Cumberland: Pure's Harris 116-1, se ne se 19-5s-7e, Oil Creek 6150 ft, abnd 6905 ft.

McClain County—Byars: Phillips' Hen 1, c se se 21-5n-3e, Viola 3466 ft, perf csg, flow 158 bbls, 3493 ft.

Muskogee County—Unnamed: Garrett's Escoe 1, c sw 16-13n-17e, T. sand 1778 ft, pump 12 bbls, 1785 ft.

Okmulgee County—Picket Prairie: Sooner O&G Co.'s Ricks 1, c s½ ne sw 21-16n-11e,, Bartles 1931-43 ft, 1,300,000 cfg, 1943 ft.

Osage County — Avant: Sinclair Prairie's (Osage) 68, se nw ne 19-23n-12e, Bartles 1629 ft, repressure well, 1762 ft.

Osage County — Nelagoney: Four States O&G Co.'s (Osage) 6, c s½ ne 13-25n-10e, Osw 1496 ft, 2000 gal acid, pump 50 bbls, 1520 ft.

Pawnee County—Hallett: Johnson O&G Co.'s Ward 1, c se ne 3-20n-7e, Mississippi 2825 ft, abnd 2975 ft.

Seminole County—Seminole City: Oklahoma Oil Corp.'s Tiger 2, c sw ne 13-9n-6e, Hunton 3978 ft, 2500 gal acid, flow 110 bbls oil, 20 wtr, 4007 ft.

Seminole County—Sylvian: J. E. Hall's Harper 1, ne se ne 10-10n-7e, Cromwell 3629 ft, flow 38 bbls, 3644 ft.

Stephens County—Coyle: Clark & Cowden's Simpson 12, c sw ne 11-1n-5w, T. sand 6142-74 ft, flow 128 bbls, 6189 ft.

Stephens County—Velma: Gulf's Hallmark 1, sw sw ne 15-1s-5w, shale 1438 ft, abnd 1443 ft.

Stephens County—Velma Shallow: Skelly's Stiefel B-16, nw se nw 35-1s-5w, sand 702-31 ft, pump 7 bbls 5 hrs, 731 ft.

Tulsa County—Dawson: Culbertson & Nuerwell's Gravitt 1, c n½ n½ se sw 28-20n-14e, Red Fork 740 ft, shot 120 qts, abnd 790 ft.

OKLAHOMA WELLS DEEPENED

Seminole County — East Earlsboro: Texas Co.'s Magruder 3, se se nw 19-9n-6e, otd 4170 ft, 2nd Wx 4195 ft, 30 bbls, 4207 ft.

OKLAHOMA WILDCATS

Beckham County—Failure: West Oak Gas Co.'s Brown 1, se se nw 36-10n-21w, Base Permian 4430 ft, abnd 4660 ft.

Caddo County—Failure: Watchorn's Lo-se-sa-nah 1, c sw ne 26-6n-12w, Pont 2190 ft, abnd 6144 ft.

Comanche County—Failure: J. G. Beard's Neese 1, se ne ne 8-1n-9w, abnd 2503 ft.

Grady County — Failure: Ray Stephens' Johnson 1-A, ne ne nw 18-5n-8w, T. sand 3293 ft, Wade sand 4350 ft, abnd 4556 ft.

Lincoln County—Failure: Wilcox's Blaney 1, se nw ne 14-14n-5e, Hogs 2105 ft, Lay 2220 ft, Ccb 2490 ft, Cleve sand 2525 ft, Osw 3257 ft, Prue 3326 ft, Bartles zone 3762 ft, brown lime 3900 ft, Miss 4065 ft, Woodford 4373 ft, Hunton 4404 ft, Viola 4554 ft, Dense 4589 ft, Dolo 4594 ft, Wx 4612 ft, abnd 4710 ft.

Lastecas' Darby 1, se se se 30-16n-5e, Avant 2138 ft, Hogs 2540 ft, Ccb 2825 ft, Osw 3483 ft, Prue 3550 ft, abnd 3616 ft.

Noble County — Oil Discovery: Atlantic's Boulden 1, se se se 12-21n-2w, Hoover 2650 ft, Oread 2765 ft, Lay 2658 ft, Big lime 4250-75 ft, sand 4290-4300 ft, 1st Wx 5145 ft, 2nd Wx 5238 ft, 1000 gal acid, flow 300 bbls, 5251 ft.

Superior's Gillham 1, ne se se 14-22n-1e, old well cleaned out from 3390 ft and pb to new sand, ripped pipe 2662-75 in Tonkawa, pump 10 bbls oil, 35 wtr.

Payne County — Failure: Wood Oil Co.'s Ramsey 1, c ne se 19-18n-5e, Ccb 2645 ft, Big lime 3070 ft, Osw 3115 ft, Prue 3237-81 ft, Verd 3281 ft, Skinner 3375-80 ft, Inola 3525 ft, Miss lime 3695 ft, Chatta shale 3860 ft, Mise 3885 ft, Syl 3887 ft, Viola 3915 ft, Dense 3945 ft, Dolo 3960 ft, 1st Wx 3970 ft, bnd 3987 ft.

Payne County—Oil Discovery: Okla. Gasoline Plants' Potts 1, nw se nw 9-18n-6e, Wheeler lime 2722 ft, brown lime 3227 ft, Burgess 3334 ft, Miss lime 3340 ft, Wood

3505 ft, Viola 3540 ft, Dense 3560 ft, Dolo 3563 ft, 1st Wx 3568-70 ft, 2nd Wx 3590 ft, pump 49 bbls, 3599 ft.

T. N. Berry & Co.'s Fee 1, nw se se 26-19n-2e, Ccb 3495-3505 ft, Cleve 3505-15 ft, Peru 3680-90 ft, Osw 3725-3910 ft, Prue 3930-40 ft, Skinner 4061-70 ft, Miss 4290 ft, Wood 4449 ft, 1st Wx 4637 ft, 2nd Wx 4698 ft, pb 4160 ft, perf 20 holes 4057-62 ft in Skinner sand, 3,500,000 cfg, 4704 ft.

EAST TEXAS

Anderson County—Cayuga: Tide Water Associated-Seaboard's Horton 4-A, 467 ft out swc 188.9-ac lse, S. Edwards sur, Woodbine 3787 ft, flow 68 bbls, ¼-in, perf Edens zone 3993-99 ft, td 4061 ft.

Wood County — Hawkins: Humble's Allen 8-D, 800 ft nsl and 1290 ft e of sec Geo. Brewer sur, but in E. Wideman sur, Woodbine 4585 ft, flow 238 bbls, ¼-in, perf 4719-33 ft, td 4780 ft.

Humble's Bryan 4-C, 2450 ft n and 1400 ft w of sec Pollock sur, but in M. A. Esparcia sur, Woodbine 4744 ft, flow 256 bbls, ¼-in, perf 4912-17 ft, td 4920 ft.

EAST TEXAS WILDCAT

Hunt County—Failure: Hollandsworth Dr. Co. et al's Baker 1, 660 ft from m/e/w and 1750 ft from m/s/s lines of W. H. Wood sur, elev 612 ft, Pecan chalk 792 ft, Austin 1670-2192 ft, Sub-Clarksville 2220 ft, Woodbine 2676 ft, abnd 2705 ft.

NORTH TEXAS

Clay County: J. C. Barnard et al's Hansard 2, 330 ft from se and 830 ft from ne lines nw-25 ac e½ lot 3, Thornberry subdvn, abnd 1158 ft.

Cooke County—Walnut Bend: Sun's Bacon 1, 2475 ft snl and 990 ft wel blk 70, Fannin CSL, flow 304 bbls ¼-in, natural, Winger sand 5470-5515 ft, td 5525 ft.

Jack County—Hoefle: Standard of Texas and Hanlon-Buchanan's Moore 1, 467 ft snl and 2333 ft ewl J. B. Jackson sur, flow 361 bbls, 20/64-in, acid 2000 gals Bend 4798-4830 ft.

Montague County—Bowers: Rogers Bros. Dr. Co.'s Grimes 1-A, 2774 ft nsl and 330 ft ewl L. Ramey sur A-630, abnd in schist 3490-3502 ft.

Throckmorton County: Trumter Pet. Corp.'s Brockman 1, 330 ft out nwc blk 75, C. I. Reserve, abnd 745 ft.

Wichita County—K-M-A: Grace & Grace's Roller 2, 710 ft nsl and 576 ft wel lot 47, R. J. Scott sur, flow 902 bbls, 2-in, shot 200 qts 4058-90 ft, td 4108 ft.

Ryan Consolidated Pet. Corp.'s Nance 132, S. O. Fowler sur, pump 23 bbls, acid 3000 gals and shot 130 qts 3768-3852 ft, td 3895 ft.

NORTH TEXAS WILDCAT

Archer County—Oil Discovery: L. T. Burns et al's Turbeville 1-R, 330 ft out swc blk 161, Robt. Carson sur, 4½ mi nw Archer City, pump 25 bbls, sand 1292-1306 ft.

NORTH TEXAS NEW PAY

Montague County — Mueller: Continental's Richardson 1, 965 ft from se and 455 ft from sw lines 61.16-ac lse and F. Hamilton sur, sw/o to 7218-23 ft Simpson prod, Bend 6020 ft, flow 383 bbls 40-gr oil, 42 water, 40/64-in, flushed 500 gals acid perf 6015-27 ft, td 6073 ft.

TEXAS GULF COAST

Matagorda County—South Buckeye: United North & South's Wendt 1, 660 ft fr nne & 660 ft fr wl of 198-ac tr, 5½-in 8190 ft, perf 8113½-16½ ft, flow 104 bbls, ⅜-in, td 8192 ft.

San Jacinto County—Mercy: Shell's Central Coal & Coke 8, start n cor James Robinson sur, go se alg nel 1997 ft, thence 4295 ft sw'ly at ra, 5½-in 8327 ft, completed open hole 8238-69 ft, flow 166 bbls ⅛-in, td 8269 ft.

TEXAS GULF COAST WILDCATS

Chambers County — Failure: Standard of Texas' State 1-136, Smith Point, abnd 10,004 ft.

Liberty County—Failure: Atlantic's Davis 1, nw flank Esperson, 3577-ac tr, David Kokernut sur, abnd 10,505 ft.

LOWER TEXAS COAST

Jackson County—North LaWard: H. M. Christie's Graves 1, e 40-ac of blk 19, Patrick Scott sur, 5½-in 5225 ft, perf 5204-08 ft, flow 104 bbls, 7/64-in, td 5255 ft.

Jim Wells County—Seeligson: Ramsey Petroleum Co.'s Bramhal 1, 520 ft fr n & 660 ft fr el of lot 2, R. P. Haldeman subdvn, Richard Ross sur, 5½-in 5968 ft, perf 5913-25 ft, flow 130 bbls, 7/64-in, td 5969 ft.

Sun's Canales 18, 1826 ft fr n & 3187 ft fr wl of J. E. Stevens sur 364, 5½-in 6001 ft, perf 5220-26 ft, flow 122 bbls, 7/64-in, td 6016 ft.

Kleberg County—Seeligson: Humble's King Ranch-Cadeza 14, GH&H 49, 5½-in 5951 ft, perf 5247-54 ft & 5440-50 ft, flow 116 bbls, ⅛-in, td 5997 ft.

Nueces County—Agua Dulce: Renwar Oil Corp.'s Knight 4, se¼ 184, 5½-in 7192 ft, flow 189 bbls, ⅛-in, td 7196 ft.

SOUTHWEST TEXAS

Jim Hogg County—East: Sun's East 2-D, 660 ft fr s'ly sl & 660 ft fr e'ly wl of 4480-ac tr, Santo Domingo de Arriba gr, 5½-in 4728 ft, flow 174 bbls, 3/16-in, from open hole at 4728-29 ft, td 4729 ft.

McMullen County—South Campana: Magnolia's Kynette 5, 1980 ft fr s&el's BS&F usr, 7-in 3050 ft, flow 9,400,000 gas, open, td 3050 ft.

Duval County — Conoco Driscoll: Continental's Driscoll 14-B, 5275 ft n of sl of 12,000-ac lse, 6-in 3195 ft, perf 2882-92 ft, flow 301 bbls, ¼-in, td 3906 ft.

SOUTHWEST TEXAS WILDCATS

Live Oak County—Failure: Bridwell Oil Co.'s Jones 1, 660 ft sw alg sel of AB&M 271, A-62, abnd 4477 ft.

Live Oak County—Failure: Continental's West 1, 990 ft fr nwl & 875 ft fr swl of lot 65, blk 35, 894-ac lse, Michael Caronican sur, abnd 2704 ft.

Webb County—Failure: Humble's Benavides 1, Pescadito area, 640-ac lse, J. Benavides sur 2008, abnd 7043 ft.

Webb County—Failure: M. L. Massingill's Watkins 1, 330 ft fr s&el's blk 21, San Casimiro gr, abnd 953 ft.

SOUTHWEST TEXAS EXTENSION

Webb County—Failure: Wise & Fallis' McLean 1, ½-mi ne McLean prodn, abnd 3426 ft.

SOUTH CENTRAL TEXAS WILDCAT

Atascosa County—Failure: Humble's Duren & Richter 1, blk 17, C. F. Simmons subdvn, Peter McGreal sur 1292, abnd 7613 ft.

WEST TEXAS

Andrews County—Embar Permian: Phillips' University-Andrews 37, c nw se sec 29, blk 10, flow 161 bbls, ¼-in, acid 13,500 gals Clear Fork perf 6175-6206 ft and open hole 6207-50 ft.

Andrews County—West Fuhrman: Seaboard Oil Co.'s Thornberry 3, 660 ft nsl and 1848 ft ewl PSL 18, blk A-42, flow 99 bbls, 1-in, gas lift, acid 5000 gals 4350-4597 ft.

Andrews County—Mascho: Whitaker Oil Co.'s University-Amerada 1-B, c se ne sec 22, blk 10, pump 132 bbls, shot 500 qts 4355-80 ft, td 4600 ft.

Crane County—Sand Hills: Magnolia's Lea 20, c nw nw PSL 9, blk 32, flow 763 bbls, ½-in, natural, 4374-4672 ft.

Cochran County—Slaughter: Bay Pet. Corp.'s Mallet-Humble 3, 580 ft out nec lab 11, leag 53, Scurry CSL, pump 166 bbls, 3% bs&w, acid 4000 gals 5029-51 ft, td 5080 ft.

Crockett County—World-Powell: Oro Peso Oil Co.'s Powell-Standard 5, 1550 ft snl and 450 ft ewl lse, EL 62, blk BB, pump 97 bbls, acid 1000 gals 2550-75 ft.

Hockley County—Slaughter: T. F. Morrow et al's Mallet 16, 580 ft out nwc lab 20, leag 48, Edwards CSL, flow 508 bbls cas, acid 15,000 gals 4860-4972 ft.

Howard County—Iatan-East Howard: Ray Oil Co.'s Foster 1-B, 390 ft out nwc T&P 43, blk 29, T-1-N, pump 140 bbls, 8% water, shot 400 qts 2640-68 ft, td 2678 ft, pb to 2668 ft.

Pecos County—Walker: Cardinal Oil Co.'s White-Baker 12-J, 330 ft snl and 1705 ft wel GC&SF 87, blk 194, flow 67 bbls, 1-in, shot 80 qts 2140-61 ft.

Pecos County—White & Baker: Cardinal Oil Co.'s White-Baker 7-L, 351 ft snl and 330 ft wel GC&SF 90, blk 194, flow 59 bbls, 1-in, shot 60 qts 1885-1902 ft.

Scurry County—Northwest: A. L. Wasson and P. J. Moran's Chapman-Magnolia 1, 990 ft snl and 330 ft ewl H&TC 100, blk 97, pump 120 bbls, shot 120 qts 1667-1730 ft.

Upton County—McCamey: Trebol Oil Co.'s Ricker-Humble 1-C, 3107 ft from se and 2078 ft from ne lines sec 6, blk R, E. C. Grooms sur, pump 77 bbls, natural, lime 2448-51 ft.

Ward County—Nichols: Cross Development Co.'s Monroe 1, 330 ft from se and 2310 ft from sw lines H&TC 5, blk 5, pump 66 bbls, 2407-27 ft.

Ward County—Shipley: Jas. H. Snowden-L. H. Freedman et al's Wristen-Gulf 11-A, 996 ft from ne and 1000 ft from se lines H&TC 18, blk 5, flow 112 bbls, ¼-in, natural, sand 2470-95 ft.

WEST TEXAS WILDCAT

Castro County — Failure: Fred Devore and Slade's Dinwiddie-Humble 1, c ne ne T&NO 10, blk 9-T, top dolomite 2800 ft, abnd 5700 ft.

WEST CENTRAL TEXAS

Coleman County: Anderson-Prichard's Coker 1-A, sec w½ ne GH&H 72, blk 2, pump 36 bbls, 8% bs&w, shot 20 qts 3006-12 ft, td 3016 ft.

Anzac Oil Corp. et al's Morris 20-J, near c of R. Roderiquez sur, abnd 2585 ft.

Jones County—Wimberly: Maracaibo Corp.'s McCoy 1, 330 ft nsl and 700 ft wel blk 67, DeWitt CSL, flow 1200 bbls, ¾-in, acid 2000 gals 2409-15 ft.

Palo Pinto County: Fred Guyer, tr's Dalton 1, 2100 ft s and 900 ft w of sec D. B. Brooks sur, but in L. B. Dayton sur A-153, abnd 4195 ft.

Shackelford County: W. S. Merrick and J. Ikard's Pittman 1, 330 ft out e cor e¼ of e¼ TE&L 541, abnd 802 ft.

Stephens County: O. J. Urban et al's Riddle 1, sw sw ne T&P 45, blk 6, abnd 2030 ft.

Taylor County—Merkel: Stayton Oil Co.'s

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Morgan 2, 330 ft out swc lot 8, Grimes CSL sur 124, elev 1801 ft, abnd 2655 ft.

WEST CENTRAL TEXAS WILDCAT

Stephens County — Failure: Cosden Pet. Corp.-A. G. Talbot's Burgess 1, 467 ft s and 1864 ft e of swc J. W. Hallett sur, but in SP 4, blk 1, elev 1142 ft, Bend 3425 ft, Marble Falls 4215 ft, abnd 4250 ft.

WYOMING

Niobrara County—Lance Creek: Continental's Apex-4 7, nw ne nw 35-36n-65w, cable, pump 66 bbls oil, 3 water, Leo sand 5550 ft.

Park County—Badger Basin: Resolute Oil Corp.'s Northern Pacific 3, c ne nw 17-57n-101w, rotary, abnd 5527 ft.

Park County—Oregon Basin: Ohio's Sonners 3, c se ne 8-51n-100w, rotary, pump 215 bbls of oil 28 bs & w, Embar lime, 3690 ft.

Park County—Oregon Basin—New Zone: Yale Petroleum Co.'s Hancock 4, nw nw ne 5-50n-100w, rotary, pump 1440 bbls 18-gr black oil; Dakota 1500 ft, Lakota 1780 ft, Sundance 2080 ft, red beds 2505 ft, Embar (saturation) 3406 ft, Tensleep 3550 ft, Tensleep (saturation) 3609 ft, Amsden 3685 ft, Madison 3907 ft, Madison (pay zone) 4155-4300 ft, Big Horn 4300 ft, Deadwood 4635 ft, td 4652, surface elev 5453 ft.

WYOMING WILDCAT

Park County—McCullough Peaks—Failure: Trigood Oil Co.'s Wilson 1, nw ne nw 28-54n-100w, abnd 2012 ft.

United States Wildcat Starts

CALIFORNIA

Kern County: Ernest F. Lang's 1, 3-28-20, Belridge North area, lcn.

Madera County: Texas Co.'s Gill 14-16, 16-13-16, Mendota area, gr.

Pure's Gamboni 1, 28-10-13, Chowchilla area, lcn.

San Luis Obispo County: Chanslor Canfield Midway Oil Co.'s G-22-27, 27-31-22, Midway-Northwest area, gr.

Tulare County: Northern Ordnance's Campbell 1, 22-22-27, Terra Bella area, lcn.

ILLINOIS

Coles County: Oxner & Ball's Hedges 1, se ne sw 6-12n-11e, dr.

Gallatin County: W. C. McBride's Shan-Hise 1, se nw se 21-8s-9e, lcn.

Hamilton County: Fred Phillips et al's Mead 1, se se nw 23-5s-6e, lcn.

Marion County: Cameron Bros.' Baum 1, ne ne se 3-4n-1e, lcn.

Moultrie County: Continental's Beachy 1, ne nw nw 13-15n-6e, lcn.

St. Clair County: G. A. Morris' Englerth 1, sw sw ne 31-1s-8w, lcn.

Wabash County: Superior's Veihmon 1, nw sw nw 9-1s-12w, lcn.

Washington County: H. C. Detrick's Massmann 1, w½ nw ne 20-2s-5w, lcn.

Wayne County: Lambert & Peek's Daubs 1, sw nw 15-1n-9e, lcn.

Williamson County: Superior's Moren 1, ne sw se 11-9s-3e, lcn.

INDIANA

Porter County: Tri States Syndicate's C. A. Lawrence 1, ne ne sw 4-36n-5w, lcn.

KANSAS

Barton County: M. M. Price's Johansen 1, c sw se 5-16s-11w, dk.

Spencer & Carlson's Prosser 1, sw c 10-17s-12w, lcn.

Butler County: Rex & Morris' Werner 1, ne c 4-29s-6e, rust.

McPherson County: Nadel & Gussman's Johnson Est. 1, c n½ nw ne 26-17s-2w, cellar.

Olson Drlg. Co.'s Janssen 1, c se sw 6-20s-3w, mim.

Pratt County: Superior of Calif.'s Hoover Est. 1, ne c 24-26s-12w, lcn.

KENTUCKY

Hancock County: N. E. Dexter et al's Shields 1, 25-R-31, dr.

McLean County: C. A. Krahn et al's Craven 6-1, 20-N-28, lcn.

Union County: Trans-Tex Prod.'s Newman 1, 13-O-19, lcn.

Weinert and Pure's Greenwell 1, 11-O-20, lcn.

Webster County: Sinclair Prairie's Higginson 1, 10-N-22, lcn.

MICHIGAN

Clare County: Pure's Christen 1, n½ ne se 11-20n-3w, rig.

Allegan County: Harris Oil Co.'s Flora 1, nw ne sw 19-1n-15w, rig.

NEW MEXICO

Lea County: Olen F. Featherstone et al's Keel 1, c nw se 13-18s-32e, lcn.

OKLAHOMA

Creek County: John J. Fleet's Adams 1, se nw 8-14n-7e, Prue sand 2860 ft, sd 2868 ft.

Charlie Beal's Murray 1, nw nw nw 12-16n-7e, dr 1090 ft.

Hughes County: Burke-Gries' Turner 1, c sw nw 8-7n-10e, mim.

Jefferson County: Seitz Comegys & Seitz' Bochtold 1, c ne nw 9-6s-6w, lcn.

Johnston County: A. K. Hamner's Aubrey 1, c sw sw 8-2s-8e, lcn.

Lincoln County: Harry Hollenbeck's Singleton 1, se se sw 7-12n-3e, rig.

Wilcox O&G Co.'s Kolar 1, c se sw 5-12n-6e, mim.

Danciger's Ralston 1, ne sw se 20-17n-2e, dr 3404 ft.

Okfuskee County: Jordan's Jefley 1, ne nw ne 14-10n-10e, rur.

Stephens County: J. G. Beard's Davis 1, nw nw ne 2-3s-5w, cellar.

EAST TEXAS

Houston County: Cherry & Kidd's Moore-Gulf 1, 660 ft snl and 660 ft from se line John Grissett sur, 5 mi w Crockett, mim Woodbine test.

NORTH TEXAS

Archer County: L. T. Burns et al's Bishop 1, 467 ft out swc blk 52, G. P. Meade subdiv of L. & M. Pasture, 3¼ mi ne Megargel, rur 5500-ft test.

L. T. Burns et al's Wilson 1-A, 467 ft nsl and 1500 ft wel ATNCL 107, 6 mi nw Archer City, 5500-ft test, dr 1900 ft.

L. C. Heydrick et al's Carter 1, 467 ft out nwc lot 10, ATNCL 97, 8½ mi nw Archer City, mim 5500-ft test.

Mrs. T. A. Norwood et al's Henry 1, 330 ft out nec w-143 of n-184-ac sec 35, blk 5, Clark-Plumb sur, lcn 1300-ft test.

W. H. Peckham et al's Abercrombie 1, 990 ft snl and 1650 ft wel of w-200 ac of s½ Wm. Cound sur, lcn 1600-ft test.

W. H. Peckham et al's Richardson 1, 330 ft s & w of m/e/nec 132.3-ac tr n½ EL 1, lcn 1500-ft test.

Baylor County: Carl Johnston et al's Richardson 1, 330 ft out nec TE&L 3101, lcn 1600-ft test.

Clay County: Sussex Oil Corp.'s Chapin 1, 330 ft snl and 990 ft ewl blk 81, Byers subdiv, lcn 1500-ft test.

Montague County: Stanolind's Cobb 1, 706 ft snl & 660 ft wel of 64½-ac tr, TE&L 2830, 1¾ mi nw Bowie, lcn 7600-ft test.

Wichita County: Akin-Dimock et al's Obenhaus 1, 1650 ft snl and 2000 ft wel of w½ of s-600 ac Jas. Cole sur, 2½ mi nw Sunshine Hill, dr 1800 ft.

Young County: Anderson-Prichard-Col-Tex Ref. Co.'s Latimer 1, 815 ft snl and 534 ft wel of s-136½ ac blk 17, Young CSL sur A-1285, lcn 4900-ft test.

TEXAS PANHANDLE

Armstrong County: Stanolind's Corbin 1, c se se H&GN 275, blk B-4, lcn deep test.

WEST CENTRAL TEXAS

Shackelford County: Fain & McGaha's Gustafson 1, sw sw nw BBB&C 169, elev 1521 ft, lcn 1650-ft test.

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TEXAS GULF COAST

Hardin County: Northern Ordnance's Weiss-Hudson 1, 6 mi e Hull, 2191-ac tr, Spencer-Osborne sur, lcn 8500-ft test.

Chambers County: Standard of Texas and Salt Dome's State-Trinity Bay 1, offshore at Ash Point, tr 17-D, Trinity Bay, lcn 9500-ft test.

Wharton County: Continental's Peterson 1, 161-ac tr, 5 mi n Louise, Juan Villa Nueva sur, lcn 6000-ft test.

LOWER TEXAS COAST

Jackson County: Stanolind's Four Way Ranch 1, 1980 ft fr n&e'ly wl of lse, J. K. Looney sur, 3 mi se Maurbro, lcn.

SOUTHWEST TEXAS

Duval County: Frank and George Frankel's Yates 1, 660 ft fr n&el of E. R. Gray sur, 468, lcn 3500-ft test.

Duval County: Quintana Petroleum's Welder 1-B, Martex area, 660 ft ne & 2640 ft fr nwl of 820-ac lse, M. G. Andross sur 24, lcn 6000-ft test.

Jim Hogg County: Humble's Mestena 3-B, Santa Rita area, 660 ft fr w & 1980 ft fr nl of sec 3 of Fowler & Rankin subdvn, Palitos Blancos gr, lcn 5400-ft test.

Jim Hogg County: Don E. March's East 1, 660 ft fr n&el of I&GN 29, 17 mi sw Hebbronville, lcn 4000-ft test.

Squeaks from the Bull Wheel

Reassuring

Oh, doctor, I'm afraid I'm going to die.

Nonsense, that's the last thing you'll do.

Successful Approach

"I cooked my first dinner last night and it was a great success."

"Really! I'm so glad."

"Yes, my husband is going to get me a cook right away."

Relieved

A woman motorist swerved to a sudden stop before the county jail.

"What's happening?" she asked excitedly.

"We just had an earthquake," explained a deputy sheriff.

"Oh thank goodness! I thought I had a flat tire."

Story From Naziland

A Berlin citizen with a thousand marks planned to subscribe to one of the war loans, but being a cautious individual, he asked a clerk who was guaranteeing the loan. He was told that the Fuehrer himself was back of it.

"But if something happens to the Fuehrer?" Then he was told Goering would carry on. "But Goering is also at the front," persisted the cautious one. "He, too, might be killed."

"In that case," said the patient clerk, "the whole National Socialist Party will guarantee the loan."

"Yes, but if the Party were dissolved, what then?"

The clerk leaned closer, whispered confidentially: "Wouldn't that be worth a thousand marks to you?"

Different

"Why did you ask her for a date?"

"Because she's so different from all the other girls I know."

"How's that?"

"She'll go out with me."

Too Polite

"Now, then, what should a polite little boy say to a lady who has given him a nickel for carrying her suitcases?"

"Lady, I'm too polite to say it!"

Impasse

"When are you to be married, Nora?"

"Indade, an' it's niver at all, I'm thinkin'."

"Really? Why, what is the trouble?"

"Tis this, mum. I won't marry Mike when he's drunk, an' he won't marry me when he's sober!"

Powerful Pills

Lucile (reading from her diary): "Up at 8. Felt a little seasick so took two pills. Passed an iceberg at 10."

Greta (listening): "My dear!"

Doctor's Orders

"I thought the doctor told you to stop all drinks."

"Well, what of it? You don't see any gettin' past me, do you?"

Bystander

"Are you the defendant in this case?"

"No sah. I'se got a lawyer to do my defendin'. I'se de man what stole de chickens."

Greek Meets Greek

Plumber: "Sorry, sir. I've forgotten my tools."

Professor: "That's all right, my good man. I've forgotten what I wanted you for."

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POSSIBLE FUTURE OIL PROVINCES of the UNITED STATES AND CANADA

A symposium conducted by the Research Committee of The American Association of Petroleum Geologists, A. I. Levorsen, chairman. Papers read at the Twenty-sixth Annual Meeting of the Association, at Houston, Texas, April 1, 1941, and reprinted from the Association Bulletin, August, 1941.

•

Edited by A. I. LEVORSEN

•

The purpose of this symposium is to get an over-all picture of the undiscovered oil resources of North America, north of the Rio Grande. Ten geological organizations have participated, to the end that this survey has behind it the authority of many geologists representing state and national geological surveys, large and small oil companies, and consulting and independent geologists. A map and a section of geology, stratigraphy, and structure illustrate each province description.

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Gas Engine

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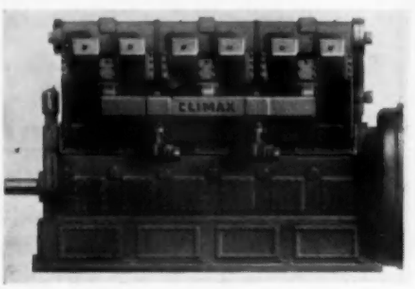
Climax Engineering Company, Clinton, Iowa, announces the V-12 Blue Streak engine. The unit is designed to deliver peak power on natural gas, butane, gasoline and other like fuels. Change-over for any fuel is quickly and easily made with standardized, outside-located accessories. Dual carburetion provides uniform fuel distribution, aiding in obtaining full power output with low fuel consumption. Venturi-type carburetors, equipped with sensitive pilot valves, provide for close fuel regulation and prevent flooding.

Dual spark-plug systems are used, guarding against partial ignition failure



Climax V-12

through the cutting out of one plug. The combustion chamber is specially shaped to assure maximum turbulence as aid to proper combustion. The shape of the chamber and spark-plug locations are designed to reduce tendency to detonate when sudden or sustained overloads are encountered.

Large-capacity cooling jackets cover the entire length of stroke. This feature, combined with wide spacing of valves and entrance of cooling water where heat is greatest, is designed to insure cool running and consequent long life.

The engine is said to have been designed and manufactured to permit maintenance by regular field or shop men, without need for special training. The low piston speeds and moderate compression ratios are chosen with a view of permitting long runs without need for servicing.

Climax V-12 is available in two bores. Model V-335, 6½-inch bore and 7-inch stroke, develops 375 horsepower at 1200 r.p.m.; while Model V-390, both bore and stroke 7-inch, develops 435 horsepower at that speed.

Dual ignition may be obtained in the following combinations: dual battery, dual magneto, or combined battery and magneto ignition. Standard design features include wet cylinder sleeves, seven-bearing crankshaft, overhead valves, aluminum (5-ring) pistons rifle-drilled connecting rod and fuel change-over devices. Where required, a complete range of accessory equipment such as starting devices, air cleaners, filters, radiators, heat exchangers, etc., may be selected to meet the specific needs of the particular installation.

Caterpillar Tractor Company, Peoria, Illinois, was recently awarded the Army-Navy E. In presenting the burgee, Brigadier General David McCoach said, "Because you have kept the faith—because you have done everything demanded of you, and more, this burgee is the visible symbol of what the United States government, your government, thinks of your work."

In separate ceremonies, Army-Navy "E" recognition was granted to both the Allenport and Monessen, Pennsylvania, plants of Pittsburgh Steel Company, March 18, conferring the honor of a two-plant award to one company in a single day. The first ceremony was held at the Allenport Works at noon followed by similar exercises at Monessen at 4 p.m. Holding "E" flag at Allenport plant, left to right: Lt. Col. Ralph L. Dunckel; P. E. Sance, works manager, Seamless Tube Division; Joseph H. Carter, president; Henry A. Roemer, chairman of board; E. J. Protin, operating vice president, and Commander Carl E. Egeler, U.S.N.R.

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Men in the Industry's News

HAYMOND C. WILLIS has joined Pan American Production Company as head of the land division of the land and geological department, with headquarters in Houston. Willis has been associated with Magnolia Petroleum Company for 16 years, and recently was in business for himself. He began his new duties on April 1. He succeeds V. I. Grisham who resigned to enter business for himself. He will terminate his services on May 1, after which time he will deal in land, leases and drilling blocks. He has been head of the land division for the past five years.

J. C. PRESTON, Owensboro, Kentucky, has been named executive secretary of the Kentucky Oil and Gas Association, following the resignation of Paul D. Bushong, who has accepted a position with Standard Oil Company of Ohio, and will be located at Shreveport, Louisiana.

H. L. MOORE, division geologist for The Atlantic Refining Company, has resigned to become manager of the exploration department of J. E. Crosbie, Inc., Tulsa. W. H. Butt, assistant to Moore, assumes the duties of division geologist with Atlantic.

M. E. FANNON has been elected vice president of the Pipe Line Department, Sinclair Refining Company, and will move from Tulsa, to Independence, Kansas, headquarters of the company. R. C. Bearden will assume the duties of executive assistant to J. R. Manion, vice president and general manager in Tulsa, the position formerly held by Fannon.

HUBERT C. STIPP, Midland district petroleum engineer for the Texas Railroad Commission, has resigned to join the production branch of the Cosden Petroleum Corporation with headquarters at Big Spring, Texas. Stipp is a graduate of Oklahoma University, and was a production superintendent for The Pure Oil Company before joining the commission in 1932.

FRED J. HILL, of the land department of Phillips Petroleum Company, Bartlesville, has transferred to Houston.

MR. AND MRS. FRANK CHAMPION are celebrating the birth of a daughter, Frances Virginia, at Los Angeles, on March 28. Champion is vice president and general manager of Byron Jackson Company.

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